MATURE SCIENCE—RETARDED PROFESSION [1]

ANDREW J. ROGERS [2]

Selection of the subject of this address culminates an interest in the professional status of entomology extending over a period of 20 years. Time and space will permit only some of the highlights of the impressions gained in that time.

In the use of examples to emphasize key points, there is no intent to be personal. On the other hand, no effort has been made to compromise the issues. To present the subject in that manner would defeat the purpose, namely, to try to arouse interest and action in a problem which to the speaker cries out for our best efforts in behalf of the profession of entomology.

THE SCIENCE OF ENTOMOLOGY

It seems doubtful that any historian [3] could set a date marking the beginning of the science of entomology that would be accepted by all workers in this field. But we need not be concerned so much with a date; it is well known that the study of insects is ancient in origin and continuous in the scientific interests and investigations of scholars down to the present time. Perhaps it could be agreed that the science of entomology took a great stride forward in the eighteenth and nineteenth centuries when the early masters of insect taxonomy established a broad base for the orderly study of insects. These early workers were not paid for their services, thus they were not "professional" entomologists in the present meaning of the term. They included many men who were trained in other professions, such as medicine, law, and the ministry, and others who had no special training and little formal education. In spite of the difficulties and hardships under which they labored, these early scientific workers laid a solid foundation upon which our present science is built, and we owe them more than perhaps most of us will ever fully appreciate.

Based upon this firm background of basic entomology, upon which all other entomological activity depends, the science of entomology in the mid-twentieth century has progressed to a position of respect and leadership second to none in the vast field of the biological sciences. To support this assertion, we need only to pick up a modern journal on the subject and marvel at the intricate and complex experiments described therein on insect control; or to read through the recent volumes of the *Annual Review of Entomology* and realize that insect taxonomy, physiology, genetics, morphology, toxicology, and other facets of the science have advanced so far as to be hardly identifiable with the concept of entomology just 100 years ago. Then reflect for a moment on the role that scientific entomology assumes in the protection of crops, livestock, commodities of all kinds, and even the very health and comfort of man.

---

[1] Presidential address, 43rd annual meeting of The Florida Entomological Society, Jacksonville, September 7-9, 1960.

[2] Entomological Research Center, Vero Beach, Florida.

[3] Unless otherwise noted, data relating to entomological history up to 1930 are from Howard (1930).

When the use of the atom for applied science became a reality, entomology was among the first of the sciences to use it for the good of mankind. And yet, even before the ink is well dried on reports describing this modern technique in insect control, deep thinkers in our science are proposing still other advanced ideas and tools for use in the perpetual battle that must be waged against insects. For instance, lethal genes (Knipling, 1960), like the sterilized-male technique, might well lead to better control and eradication without most of the undesirable side effects of present methods such as chemical control.

So vast and complex has our science grown that we who call ourselves modern entomologists might well experience a sense of awe, as well as pride, when the full realization of it is apparent, and yet we also must realize that these advancements which seem so great now are really only a preview of things to come. The point to make for the purpose of this address is that scientific entomology has grown to maturity in the mid-twentieth century. However, before we become too complacent about this great scientific progress, let us reflect honestly and soberly for a few moments on another aspect of entomology—the professional aspect.

The Profession of Entomology

This brings us to the principal subject of this address and again it is necessary to step back into history, though not so far, to introduce the subject.

Although Dr. T. W. Harris was paid a small sum in 1841 for his report on the injurious insects of Massachusetts, most workers seem to agree that the appointing of Dr. Asa Fitch as State Entomologist of New York and Mr. Townend Glover as the first Federal Entomologist in 1854 marks the real beginning of professional entomology. We celebrated the centennial of professional entomology in 1954, and although the speaker worked diligently in that program, it must in all honesty be admitted that this was done with an inner feeling that we had not made the progress in professional entomology that we should have made in 100 years.

Space and time will not permit, and reason does not dictate, that the history of professional entomology in the last half of the nineteenth century be retold here in detail. But as a background for thought, it seems desirable to name this period the "Golden Age" of entomology.

We all are aware of the many great scientific workers and teachers of that period, but it seems more germane to the point of this address to mention a few of the men who are typical of those whose activities in public affairs really laid the groundwork for our profession.

If no other man had lived and worked as a professional entomologist from 1850 to 1900 except C. V. Riley, we still could classify this period as the "Golden Age" of our profession. He obviously was a man of extraordinary ability, and wherever the circumstances demanded a strong personality and a champion for professional entomology in public affairs, he was there. He is credited, among many other things, with wresting from the U. S. Congress the bill that established the United States Entomological Commission in 1876.

Dr. L. O. Howard also was among the staunschest professional entomologists of his time. He must be credited with saving the Division of En-

tomology from being consumed by the newly created Bureau of Animal Industry in 1898.

Benjamin Dann Walsh, in addition to being a man of exceptional scientific ability, obviously was a professional entomologist of great stature. His gifted pen recorded the nature of his strong convictions in defense of his profession. "Quack entomologists" and their equally "quack" concoctions for controlling insects were a drain on the public pocketbook 100 years ago just as they are today, and Benjamin Walsh did not hesitate to use his writings to expose and condemn these parasites who bilked the public in the name of his profession. This might also be called the period of State Entomologists, men equal in professional rank to State Chemists, State Veterinarians, etc. Their work and prestige lent much stature to professional entomology.

In this infant but golden age of professional entomology, these men and others whom they typify built for us a strong foundation in public affairs relating to our science and much of their influence carried over into the early decades of this century.

The Division of Entomology in the U. S. Department of Agriculture became the Bureau of Entomology in 1904. The first federal insecticide law aimed primarily at protecting the public against fake insecticides was passed in 1910, largely through the efforts of a permanent committee on insecticides in the Association of Economic Entomologists. The first federal quarantine law was passed in 1912, largely through the efforts of Dr. C. L. Marlatt, working directly with the Congress and in spite of opposition from the National Nurserymen's Association. Thus the Golden Age of professional entomology extended at least from 1854 to the second decade of this Century.

Scientific entomology continued to progress and grow and, as previously stated, has became mature in our times. But it is the speaker's firm impression that the professional side of entomology, beginning sometime in the first quarter of this century, became retarded and has not kept pace with the development of the science. All of the causes for this would be hard to define, but it seems worthwhile to speculate on a few factors which seem obvious and to consider the present situation.

Entomology, more than any other branch of the biological sciences, affects almost every major facet of human activity. One of the effects of this, as the science expanded, was to bring men of other professions into the field of entomology—men trained in professions already firmly established, such as medicine, engineering, and chemistry. With their strong professional status, backed by strong organizations, these men were in a position to take charge and direct certain entomological programs in which they shared a common interest, and this situation has continued to a great degree up to our time.

This analysis is not intended to be a general criticism of other professions working in entomology. In all fairness we must admit that many of the early "greats" in entomology were trained in other professions. And it was medical men who made the early discoveries of such far reaching importance to medical entomology in the last century. And with these discoveries came the engineers who were needed for drainage projects. And with expanding agriculture there was a demand for better insecticides and spray machinery which required the help of chemists and again the en-

gineers. It also must be said that some of these workers forsook the principle activities of their own profession and have devoted long and useful lives to a particular facet of entomology. There are the many eminent malariologists among medical men, and some engineers have devoted their professional careers to mosquito control. These men are not the subject of the main point of this discussion; they usually are eminently qualified for their particular work with insects and are accepted as such by professional entomologists. But it does not follow that all medical men and all engineers are innately qualified to direct entomological programs.

A good case in point may be quoted from Cushing (1957), writing on entomology in World War II, "When the United States obtained bases in the Caribbean the problem of malaria control again arose (at Trinidad) . . . . Representatives of the medical department of the Army, without adequate training in malaria control, surveyed the situation, and upon their recommendations several million dollars were spent in effecting the complete drainage of suspected breeding places, without noticeably reducing the local incidence of malaria. An entomologist was chosen to make a study of this problem. After a few weeks investigation, he discovered that the responsible vector was breeding in water-holding bromeliads growing parasitically upon the forest trees surrounding the base. A treatment devised to destroy the bromeliads quickly brought malaria in the cantonment under control. This example clearly indicates the need for well-trained entomologists who know the varied biologies and habits of *Anopheles* mosquitoes, to advise or direct the efforts in any future mosquito-control campaign."

In the Secretary's Report to the Fifty-Sixth Annual Meeting, American Association of Economic Entomologists, 1945, Dr. Ernest N. Cory had this to say in support of combining the two national entomological societies, "If we can judge by the history of organization in medicine, engineering, and chemistry, it would seem that a consolidation would improve conditions within the profession of entomology. Entomology has been subservient to engineering and to the medical sciences in this war and although there has been a greater realization of the importance of entomology, there has been no admission by either of those professions that their technique in meeting disease conditions is predicated on entomological knowledge." (Cory, 1945).

In spite of their handicap of lesser professional status, entomologists in and out of service set an enviable record in the service of their country in World War II. But that story need not be retold here.

Misplaced and unqualified direction of entomological activities are not limited to medical and veterinary entomology. For example, a well known horticulturist gained control over state direction of insect control in California near the end of the last century and, in the opinion of some, retarded the progress of economic entomology in that state for about 20 years because of his unjustified zeal for biological control to the exclusion of other methods (Howard, 1930).

Another related factor that, in the speaker's opinion, has had an important part in retarding the growth of professional entomology again relates to the division of the science into a great many more or less unrelated activities. With expanding agriculture and other areas of human activity, entomology became more specialized and more divided. Today we are a very loosely joined group of specialists, each absorbed in a narrow

line of work and thought, more or less unilateral thought, directed toward a particular field of interest in entomology. This is in direct contrast with conditions 75 years ago when professional entomologists had more interest in common and worked and acted as a closely-knit group.

Under the present conditions it is easier for administrators in allied fields to absorb here and there a specialized facet of entomological work and workers. This is one of the most fatal things that can happen to any profession. The fight has been uphill since Dr. L. O. Howard's struggle with this problem in 1898, and in this present decade the Bureau of Entomology was finally dismembered in the Department of Agriculture. Any entomologist or entomological society who did not do all within their power to prevent this must accept their share of the responsibility for this setback to entomology in our times.

Turning attention now to the state level, let us take a brief look at the present situation in Florida, for example. There are at least five state boards, commissions, advisory committees, or technical committees defined and established by law in this state which function entirely or in large part in some field of entomology, and it is not required by law that an entomologist be appointed to any one of these. In fact, several of these laws do not even mention the words entomology or entomologist. This indeed is a sad commentary on the present status of professional entomology in this state. It seems highly improbable that there could be a law establishing a state board to supervise or advise on drainage problems that would not require engineers on the board.

The field of structural pest control offers another opportunity to evaluate the professional status of entomology in Florida. There is a large segment of this industry which offers the public a much-needed service in insect control on a high level of efficiency and business ethics. This legitimate segment in pest control, including some members of this Society, has too often been forced to work under a stigma of adverse public opinion imposed upon their industry by the depredations of the same kind of public parasites that Benjamin Walsh wrote about almost 100 years ago.

In 1947 a law was passed with the hope that the problems of this industry could be solved for the benefit of the legitimate industry, the public, and the profession of entomology. Although some progress has been made, it seems clear to one who has observed this situation over a period of years that this law has only been partly successful. Information from the files of the State Board of Health on violations of this law by certain firms, including some still licensed to do business in this state, is enough to convince the speaker that this law is not adequate to keep this element of the industry from pursuing its nefarious practice of fleecing the public in the name of structural pest control. To read the record of some of these violations, especially those affecting elderly widows, will chill the heart of the most insensitive.

To try to fix the blame for the apparent failure of this law to fulfill its objectives is beyond the scope and purpose of this address. But one thing seems clear: the time is far past due when the professional entomologists of this state should have assumed their rightful responsibilities to the responsible segment of this industry and to the public in this important branch of economic entomology. This leads directly to the field of public relations.

In the final analysis, professional status and prestige are only measures of the esteem in which a profession is held in the public view. It must be remembered that legislative bodies are important segments of the public and it is in these bodies that laws are passed and appropriations made for most entomological work.

Important laws relating to entomology are introduced, considered, often amended by actions of pressure groups with a selfish motive, and passed in nearly every session of the Florida Legislature. The Legislature and the Governor are able to judge these laws only by the information presented in support of, or opposition to them. To the speaker's knowledge, the professional entomologists of Florida, acting as a group, have never offered their advice and counsel to the State Government or to the public in these matters. Legislators cannot justly be blamed for their shortcomings in passing on appropriations and other laws relating to our science and profession if we refuse to advise them on these laws and to inform them on the nature and value of entomology to the citizens of the state.

Outstanding public contributions through the science of entomology such as, for example, the dramatic screwworm eradication program, offer excellent opportunities to enhance the professional status of entomology through a well-planned public relations program. But these contributions are of doubtful value for this purpose so long as entomologists do not occupy the top-level positions in directing these projects.

Well-meaning but often poorly-informed conservationists and others who frequently write in the public press continually harass the field of economic entomology with unfounded and often fantastic claims against the use of insecticides, and no one publicly refutes these claims. This indeed is poor public relations. It is respectfully suggested that this offers another opportunity for the Florida Entomological Society to set a good example in support of professional entomology in Florida.

It has been the speaker's observation that we in entomology have too often confused the matter of public relations and professional responsibility with getting into politics. When considered in their true perspectives, there is no relationship between these two concepts. Assuming responsibility in matters affecting one's profession in the public interest is simply good scientific and professional citizenship in the same way that taking a public stand on moral issues in one's community is good Christian citizenship.

It also seems pertinent to the subject to see how entomologists fare salarywise as compared to similar professions. For instance, physical scientists entering the U. S. Public Health Service in the grade GS-5 today start at the top of the salary range, $5335, and entomologists start in this same grade at the bottom, namely $4335. This presumably is justified by the physical scientist being in short supply whereas entomologists are not, a contention which many of us who have been trying to hire qualified entomologists find hard to accept.

When one considers that no fewer than 46 employees of the Bureau of Entomology were making $4000 to $4600 thirty years ago (Howard, 1930), the starting salary of $4335 for the entomologist entering Federal service as a GS-5 today does not reflect much progress. Until just a few weeks ago the Florida Merit System was offering $3960 for the beginning grade of entomologist. This has recently been raised to $4320. The start-

ing salary for Entomologist II in the Florida Merit System is $4800; for Sanitary Engineer II it is $5520.

Another interesting comparison of this type may be cited from data published by the National Science Foundation (1960) for the years 1956-1958. Of 14 scientific classifications considered, agricultural sciences ranked second from the bottom in median salaries and the biological sciences ranked third from the bottom. In terms of median salaries for academic degrees earned, salaries for chemists and sanitary engineers with less than the master's degree stood well above those for the Doctor of Philosophy degree in the agricultural and biological sciences.

It is not intended to imply that lesser professional status is the only factor accounting for this state of affairs, but it would be equally unrealistic to disregard this factor in evaluating this situation.

We might also profit by reflecting for a moment on current student enrollments and their relationship to providing trained workers for the future. Undergraduate enrollments in agriculture at Land-Grant institutions declined 31 percent from 1948 through 1959.[4] The causes for this probably are numerous and complex, but again it would seem unrealistic to disregard professional status and salary conditions such as those just quoted as important factors to consider.

In an effort to determine trends in entomological training in the period 1948 through 1960, a survey was made by the speaker of a cross section of departments of entomology in the United States. Replies to this survey are incomplete at this time, but data from eight schools indicate that the number of undergraduate degrees conferred in entomology fell abruptly by about 50 percent after 1950-51, the peak years for graduations in the veterans training program after World War II, and remained, on an average, at this lower level from 1952 through 1960, with no definite trend indicated. These data also show a slightly upward trend in graduate degrees conferred in entomology since 1948 and in six schools which confer degrees in entomology at all levels, there were more graduate than undergraduate degrees conferred in 1960, with the doctor's degree taking first rank, the master's second, and the bachelor's last. The indicated increase in graduate training in entomology is encouraging, but there seems to be reason for some concern about undergraduate enrollments.

Numerous plans have been tried for attracting bright students to entomology, with the main effort aimed at arousing the student's interest in insects. These plans have helped but they have not solved the problem. It seems reasonable to suggest that these efforts now be supplemented with a method which obviously works so well in some other areas of study, namely, to take steps to offer the bright student a chance to enter a stronger profession where he can reasonably expect to earn a standard of living at least equal to that which he well knows can be had in similar areas of study. His interest in insects can be as valuable when acquired in the course of study as when aroused prior to this time.

The science of entomology has progressed because it has dared to change to keep abreast of new and expanding problems. If the profession of entomology is to resume its interrupted development, we who comprise this

[4] Based upon statistics furnished by the College of Agriculture, University of Florida.

profession also must dare to change a philosophy which, in the speaker's opinion, has retarded the growth of our profession. As individuals we must rise above being just taxonomists, insect physiologists, insecticide testers, etc.; we must first be professional entomologists in the broadest meaning of the term. And as societies we must rise above being just once-a-year conventioners and publishers of scientific journals; we must assume our appropriate responsibilities in public affairs relating to the science and profession of entomology and take a more tangible interest in problems affecting the individual members of our societies. We must pursue this task with a renewal of the spirit that motivated men like Riley and Howard. The problem will require appropriate tact and dignity, but also firmness and resolution. It is difficult to imagine how the science of entomology can continue to grow indefinitely without the support of a stronger professional organization.

These would be well-meant but empty words if they were not backed up with some positive suggestions for proceeding at least within the limitations of our own society. In closing, it is a pleasure to advise you that your Executive Committee and several special committees have given much attention and thought this year to the matter of enhancing the status of professional entomology in Florida. There is good reason to believe that, as this meeting progresses, the membership will be able to observe and consider these efforts.

Literature Cited

Cory, Ernest N. 1945. Proceedings of the fifty-sixth annual meeting, Amer. Assoc. of Econ. Ent. Report of the Secretary. Jour. Econ. Ent. 38(1): 131-132.

Cushing, Emory C. 1957. History of entomology in World War II. Publication 4294, Smithsonian Inst., Washington, D. C.

Florida State Board of Health. 1960. Regulations governing commercial spraying of lawns and ornamental shrubbery in residential areas with highly toxic pesticides.

Florida State Board of Health. Records relating to Ch. 24364 (No. 750), 1947; Ch. 482, 1955; Ch. 482, 1959; Florida Statutes.

Florida Statutes: Ch. 487; 581; 585; 59-261.

Howard, L. O. 1930. A history of applied entomology. Publication 3065. Smithsonian Inst., Washington, D. C.

Knipling, E. F. 1960. Use of insects for their own destruction. Jour. Econ. Ent. 53(3): 415-420.

National Science Foundation. 1960. Scientific Manpower Bulletin. No. 11. Washington, D. C.

A REVIEW OF THE FRUIT FLY RESEARCH PROGRAM OF THE U. S. DEPARTMENT OF AGRICULTURE ENTOMOLOGY RESEARCH DIVISION [1]

B. A. Porter and L. D. Christenson
Entomology Research Div., Agr. Res. Service, U. S. Dept. Agr.,
Beltsville, Maryland

A lengthy discussion of the importance of fruit flies in areas in which they are established, and their potential importance to horticulture elsewhere, is unnecessary before a group of Florida entomologists. In the last 30 years or so you have seen two outstanding eradication campaigns against the Mediterranean fruit fly, each one costing many millions of dollars. And the Mediterranean fruit fly is only one of dozens of species that might be serious handicaps to the horticulture of this State if they should become permanently established here. Some thirteen of such species are shown in the exhibit in the lobby at this meeting, placed there by the State Plant Board of Florida.

The threat of these fruit flies is steadily increasing, with the stepping up of the volume and speed of airplane traffic from foreign countries and the finding of more and more areas infested by the Mediterranean fruit fly in South and Central America. The hazard of another accidental introduction into Florida will continue to grow unless there is a corresponding increase in our ability to keep infestation out or render it impotent by radiation or other treatment of incoming luggage and parcels. Undoubtedly advances in both of these fields will occur. Our standard procedure in dealing with fruit flies should always be their prompt detection, and eradication before extensive areas of infestation can develop.

In recognition of the continued threat imposed by the various species of fruit flies, and in order that we may be in a position to meet, on short notice, any fruit fly emergency that might develop, the Department maintains a continuing strong effort to find even better detection, commodity treatment, and control and eradication techniques for several major species of fruit flies, that can be used safely without appreciable public inconvenience. This program is actually not new; it has been going on, with numerous ups and downs, for nearly 50 years. From 1912 to 1917 the late E. A. Back and C. E. Pemberton made intensive studies of the biology of the Mediterranean fruit fly (*Ceratitis capitata* Wied.) and the melon fly (*Dacus cucurbitae* Coq.) in Hawaii, and published papers that are still consulted extensively. In 1928, following the finding of the Mexican fruit fly (*Anastrepha ludens* [Loew]) in the lower Rio Grande Valley of Texas, A. C. Baker, C. I. Bliss, and M. McPhail undertook work with this species in Mexico. Field studies and laboratory research (the latter under rigid safeguards) were carried on with the Mediterranean fruit fly in Florida in 1929. As the eradication effort approached its successful conclusion, this work was transferred to Hawaii, where abundant infestations still existed. This program was greatly expanded in the late 1940's, soon after the de-

[1] A talk presented at the 43rd annual meeting of the Florida Entomological Society, Jacksonville, September 7-9, 1960.

velopment in Hawaii of alarming populations of the extremely destructive oriental fruit fly (*Dacus dorsalis* Hendel). In the early 1950s the finding of the Mexican fruit fly in Southern California, close to the Mexican border, also stimulated our fruit fly research.

With a history of research over a period of nearly 50 years, the question might be logically asked whether we couldn't finish the job and go on to some other pressing problem. The answer is that it isn't that kind of a job. New conditions are continually developing, new fruit fly species may threaten, and new materials and control procedures should be developed and thoroughly evaluated in order that our defenses may always have the maximum effectiveness.

Although the title of this paper refers only to work of the U.S.D.A. we wish to point out that many phases of it have often been carried on jointly with State and other non-Federal agencies. Time and space limitations prevent a detailed discussion of the contributions made to our fruit fly knowledge by numerous cooperators over the years. Such cooperation has been extensive, especially when emergencies existed or appeared imminent. The original work in Hawaii was cooperative with local agencies, and this cooperation is still in effect. During both "medfly" campaigns in this State, Florida workers made important research contributions to meet practical problems encountered in the eradication program. Beginning in 1949, a University of California research team, under the direction of the late Harry S. Smith, participated very actively for several years in the oriental fruit fly research program in Hawaii. They also designated P. S. Messenger, a member of this team, to represent California in bioclimatic studies of the Mexican fruit fly, carried on at Brownsville, Texas. Numerous other contributions have been made by State and other agencies. In Mexico, of course, the cooperation is with the Mexican Government. These are but a few instances of active cooperation. Some of the most important advances have evolved from the work in which other agencies have actively participated.

Our fruit fly research has several unusual features. For one thing, most of this research is being carried on in advance of any practical immediate need for control measures. The Mediterranean fruit fly, the oriental fruit fly, and the melon fly, although present in Hawaii, are not known to occur in the continental United States (although two oriental fruit flies were recently found near Anaheim, California, intensive survey has not revealed any additional specimens, so these may not represent an established infestation). The Mexican fruit fly invades the southern Rio Grande Valley of Texas annually and flies are trapped occasionally in the Tijuana area in Mexico. Although we know of no permanent established infestation of these fruit flies in the continental United States, it has seemed the part of wisdom to develop as much information about them as possible in order that methods of survey, field control, and commodity treatments may be available for immediate use in case any of these or related species should appear in our southern fruit-producing areas. As you all know, this policy paid off when the "medfly" was found in your State in April, 1956. If the research workers had been obliged to start from scratch and had had no experience with the new insecticides and other newer approaches to control, the eradication program, although it would undoubtedly have been successful, might have required much more time and more extensive financ-

ing. Our research is being continued on a moderately large scale so that we can continue to be prepared for any emergency that may develop in the future.

A second feature in which this research program differs from most others is the fact that it is being carried on mostly outside of the continental United States. We are fortunate in not having infestations on the mainland. We therefore have large, well-organized laboratories in Honolulu and Mexico City. In Mexico we are dealing with the Mexican fruit fly and some other species in what is probably their native home. In Hawaii we are dealing with the three migrant species mentioned earlier. They are not in their original home but are present in sufficient numbers for effective experimentation.

In developing our fruit fly research program we are giving special emphasis to several of the newer approaches to insect control. Such approaches are essential if we are to meet effectively the numerous challenges that we face, such as spray-residue problems, and problems of increased resistance to insecticides formerly effective in insect control. The fruit fly project is in an unusually good position to explore a number of these other approaches.

A major undertaking which we now have underway is an effort to extend the sterile-male technique to fruit fly control. You are, of course, familiar with the remarkable success of the screw-worm campaign which was completed here in Florida a year or two ago following an earlier success on the Island of Curaçao. By flooding the area with male flies made sterile by irradiation it was possible to cause practically all female flies to lay only sterile eggs, and the species disappeared. Although many details would be different and larger numbers of sterile males might be needed, we see no essential reason why this method would not work against fruit flies. It should be remembered, however, that a few months would probably be needed to develop the facilities and fly stocks that this procedure requires. In dealing with incipient infestations of an emergency nature, other eradication methods would have to be employed immediately. The liberation of sterile males might later provide the final push needed for complete eradication.

Methods have been developed whereby certain of our species of fruit flies can be economically produced in tremendous numbers, and sterile-fly experiments are being inaugurated on isolated islands in the Western Pacific in cooperation with the Military and Trust Territory Authorities. Probably the first sterile flies will be dropped from U. S. Navy aircraft within a few weeks. The use of isolated islands is necessary to prevent reinfestation from nearby sources. Fruit flies of many different species range over a great deal of territory. Mexican fruit flies apparently move over 100 miles or more of semi-arid terrain to invade citrus areas in Texas every year. Marked oriental fruit flies have been retaken in traps as far as 26 miles from a liberation point, having crossed at least 9 miles of water in the course of their flight. In one recent experiment, 133 oriental fruit flies were recovered in traps located 9 to 11 miles from the release site. Similar results have also been obtained with the melon fly. It is easy to see that an experiment in eradication in a limited area adjacent to sources of infestation would be doomed to failure from the outset, although the population might be brought down almost to the vanishing point.

Chemical means of sterilizing insects or otherwise affecting their reproduction, growth, or genetic makeup are also receiving intensive attention in Mexico and Hawaii. Highly effective compounds which have already been discovered give rise to the hope that we may some day be able to use antireproduction agents in combination with protein hydrolysates or other lures in entirely safe ways in the field to eliminate fly populations. If found unsafe where warmblooded animals are involved, such materials might be used in rearing media to produce sterile flies for liberation.

Another possible means of large-scale control of fruit flies involves the use of powerful chemical attractants. Fruit fly lures, especially those such as methyl eugenol and protein hydrolysates that incite feeding responses, are ideal vehicles for administering poisons, pathogens, and hormones that may induce unfavorable activity or behavior. Perhaps even antibiotics can be so dispensed through their destruction of essential symbiots in the guts of the fruit flies, they may limit biotic potential.

In the lure research, chemicals that attract males have been found with much greater frequency than those that attract females. Promising results were obtained with methyl eugenol against the oriental fruit fly in a large area in the Hawaiian Islands; since practically all the male flies were eliminated in that experiment, arrangements have been completed for an eradication experiment involving the entire Bonin Islands group south of Japan. Aerial drops of cane fiberboard wafers impregnated with a methyl eugenol-dibrom mixture, which attracts and kills the male flies, are currently getting underway. Also under consideration are similar experiments in controlling the melon fly with cue-lure a recently discovered attractant for male melon flies. This method of control is called the "male annihilation technique" by our workers in Hawaii.

Although we are emphasizing newer lines of attack, we are by no means neglecting the older approaches. An important part of the fruit fly research program is the effort to develop better and more attractive chemicals for use as lures in traps or with insecticides for direct control. A quick, ready method of detecting the presence of the fruit flies is essential to an effective eradication program. The finding late in the winter of 1955-56 of a material extremely attractive to the "medfly"—oil of angelica seed—was a most fortunate circumstance when the "medfly" reappeared in Florida about 6 weeks later. The subsequent development of effective synthetic lures by workers of our Hawaii laboratory and chemists of the Entomology Research Division at Beltsville, Maryland, saved the day when the world supply of angelica seed approached exhaustion. The later availability of even better lures for the "medfly", synthesized by Division chemists, bodes well for the success of any further eradication campaign which may become necessary.

Our work with the lures is continuing, although we now have extremely effective ones for the oriental fruit fly (methyl eugenol), the melon fly (cue-lure), and the "medfly" (trimedlure). A good male lure that can be used in a dry trap is still badly needed for the Mexican fruit fly. The screening of several thousand candidate materials, including many that have proved of value on other species of fruit flies, has not revealed anything of much value. Although no spectacular lure for the Mexican fruit fly has been found, a fairly good one for use in liquid-containing traps is a mixture of water and corn protein hydrolysate (SIB-7). This mixture has the ad-

vantage of attracting female flies as well as males, and it has been attractive to most, if not all, of the tropical fruit flies on which it has been tested. A fermenting liquid lure containing sugar, yeast, and pyridine is also attractive to both sexes of the Mexican and other fruit flies. The pure chemical lures attract mostly male flies, and are quite specific in their action, usually attracting only one species of fruit fly. Someday the Mexico City laboratory will find an outstanding lure that will greatly facilitate any eradication or suppression program against the Mexican fruit fly and that may be of value for measuring populations in connection with the research program.

Further studies are being made of traps, with special reference to those in which several lures can be used, to capture as many species as possible in the course of a detection program. The so-called multi-purpose dry traps were developed to attract the oriental fruit fly, melon fly, and Mediterranean fruit fly. Observations elsewhere have revealed that the lures used in these traps will also attract a few other kinds, including the Queensland fruit fly (*Dacus tryoni*) that is so damaging in Australia. Obviously the many dozens of fruit flies occurring the world over include numerous other species that are also of concern to us. The conventional McPhail traps containing fermenting or protein hydrolysate liquid lures provide the best insurance of quick detection of fruit flies in general, since they are more effective specieswise than dry Steiner traps baited with presently available male lures. Detection systems should make frequent use of these liquid traps. The strong role liquid traps play in the Mexican fruit fly program and the need for them in precautionary detection programs have given continuing significance to the research underway in Hawaii and Mexico to improve liquid lures and our methods of using them.

Our laboratories are still doing considerable work with new insecticides and bait spray combinations, although in Hawaii most of this work has been temporarily slowed down to permit major emphasis on the new methods of large-scale control already outlined. Most of you are familiar with the bait spray which was used so successfully in the eradication program here in Florida in 1956 and 1957. The development of this spray combination is a striking illustration of the value of cooperation and of basic research. As part of the cooperative effort on the oriental fruit fly organized under the direction of Walter Carter, entomologist of the Pineapple Research Institute, Honolulu, basic studies on nutrition, conducted by Kenneth Hagen and Glenn Finney of the University of California, revealed that certain hydrolyzed proteins are either essential or very important in the diet of the adult fruit flies. When such materials were included in their diet, the adult flies developed sexual maturity and were much more vigorous, lived longer, and laid more eggs. It is believed that similar materials are the normal food of the adult flies and are usually available in deposits of insect honeydew and other secretions and materials present on fruit trees and elsewhere in nature.

While this basic work on nutrition was going on, L. F. Steiner was making an intensive study of insecticide materials. He decided that a combination of one of the protein materials, to which the flies were attracted and on which they fed, with one of the quick-acting insecticides, should be very effective in control. This was promptly confirmed in laboratory and field experiments. The attractant material in the new bait spray was much

more effective in causing the flies to concentrate their feeding on the spray deposits than the sweetened materials used previously, and the quick acting poison killed them shortly after they started to feed. With the use of such a mixture a complete, thorough coverage is not essential, since in moving around the fruit flies are certain to find deposits and feed on them. A heavy deposit is likewise unnecessary; a light spray will do the work. These combinations worked very effectively in small plot experiments; they were better in commercial use in certain orchards in Hawaii, and apparently gave perfect results in Florida against the medfly.

What started out as a cooperative fundamental study of insect nutrition formed the basis only a few years later of a formulation that was the mainstay of a $10,000,000.00 practical control operation. As the late L. O. Howard used to say, all entomology is economic.

Soil insecticides are currently being investigated for their supplemental usefulness in fruit fly eradication campaigns. The extent to which their residual effectiveness may be influenced by weathering, and the degree of control that may be expected from soil insecticides alone when they are used in large area applications are currently under study in long-range tests in both wet and dry climates in Mexico.

The development of commodity treatments which provide greater coverage of the different kinds of fresh fruits and vegetables that may be subject to regulation in eradication campaigns is an ever-present challenge. Treatments which can be used on some hosts and not on others because of injury or other factors impose undue hardships on some growers and cause misunderstandings.

Important among the conventional commodity treatments is the use of ethylene dibromide. The promise of this fumigant against fruit flies was a joint discovery of J. W. Balock of our fruit fly laboratory in Hawaii and D. W. Lindgren of the California Experiment Station at Riverside. Its later development into approved fumigation treatments has helped solve many fruit fly introduction risk problems. In the Rio Grande Valley of Texas it has replaced the vapor heat process, which was effective but time-consuming and was claimed to injure the fruit under some conditions. The ethylene dibromide treatment was also used to good advantage in the recent medfly eradication program in this State.

Ethylene dibromide residue data are being developed that will ultimately permit establishment of tolerances for additional Florida commodities. In the most recent campaign, blanket approval was given for use of ethylene dibromide fumigation in the emergency situation then existing. Policy with respect to further campaigns cannot be predicted. Studies to provide information on the tolerance of fruits and vegetables to fumigation and other treatments and on fumigation procedures, conducted by the Florida Experiment Station, are a most welcome and significant phase of our present preparedness research program.

Considerable work is still being done with commodity treatments in Hawaii and Mexico. Studies are being made of possible fumigants other than those now in regular use, with dips containing fumigants in solution, and with fruits that do not stand the usual type of fumigation or in which present fumigations are inadequate. The avocado falls in the two classes last mentioned, but we are hoping to find some way of conditioning avocados

so that they can stand an effective fumigation treatment. Time limitations prevent us from discussing this work in any more detail.

In the research to find treatments with broader spectrums of application some attention is now being devoted to irradiation. This has appeared to be very promising from the standpoint of mortality of the fruit fly. However, the problem of rapid application of the required dosage to large volumes of produce, and the need for food wholesomeness and biochemical studies to make certain that radiation will not cause toxic or carcinogenic byproducts in the treated produce, suggest that it may be some time before this development can reach a practical application stage.

Further attention, on a limited scale, is being given to the biology, ecology, behavior, and biological control of fruit flies. Mention has already been made of the flight and dispersion habits of some of the fruit flies. Bioclimatic studies of several fruit fly species, carried on in Hawaii and Brownsville in specially constructed cabinets to determine the climatic requirements of the fruit flies, are being continued on a reduced scale at the latter point. Questions are regularly coming up on the host status of various fruits, questions to which an unqualified answer is usually impossible, although we try to reach as definite conclusions as we can. Further observations are being made on the biological control of fruit flies, and parasite material is being sent from time to time for introduction in various other countries.

In the development of precautionary fruit fly detection programs, the relative importance of fruit flies from the standpoint of the hazard of introduction and potential for damage if established in Florida or elsewhere in the United States furnishes interesting speculation. Our experience with the "medfly", oriental fruit fly, and melon fly, and the frequency with which they are intercepted at our borders certainly establish these species as major threats. The emphasis assigned to them in detection programs appears to be fully justified. For many of the other fruit flies, hazard to United States agriculture is probably best measured for practical purposes by the hosts they infest, the geographic location of infestations, and the frequency with which they make their way into trade and travel channels. It is good policy to consider that all fruit flies will do well in the United States and have potential ability to become serious pests, until an adequate biological basis for concluding otherwise becomes available.

NOTICE TO MEMBERS

The Board of Governors of the Entomological Society of America, at the 1960 Annual Meeting of the Society in Atlantic City, approved the affiliation of the Florida Entomological Society with the national organization. The application for affiliation was submitted in accordance with the wishes of the Florida Society expressed at the 43rd Annual Meeting in Jacksonville.

WINNING COMBINATION IN EVERY DROP

No insecticide has yet approached malathion's combination of powerful, wide-range insect control and low toxicity to man and animals.

One drop of malathion is all it takes to kill 300,000 aphids . . . yet *you* don't need a respirator or special protective clothing to handle it safely.

For fruit and vegetables, malathion offers control of most major insect pests. It can be used close to harvest *without* residue problems . . . up to 1 day on some crops, three days on most crops.

For fruit, malathion offers powerful insect control with safety for finish of sensitive apple varieties.

Write for MALATHION GROWER'S GUIDE PE-5039: American Cyanamid Company, Agricultural Division, 30 Rockefeller Plaza, New York 20, N. Y.

CYANAMID

MALATHION

INSECTICIDES

CYANAMID SERVES THE MAN WHO MAKES A BUSINESS OF AGRICULTURE

NEW NORTH AMERICAN TABANIDAE. XII. A NEW VARIETY OF *TABANUS IMITANS* WALKER

Cornelius B. Philip [1]

Tabanus imitans Walker shows variation in the southeastern coastal states from North Carolina to Texas. Stone (1938) described variety *excessus* from Florida which lacks the dorso-basal extension of the antennal plate in both sexes. Described below is another variety, *pechumani*, which has typical, hooked antennae, but shows other consistent differences. The hairs of the legs, subepaulets, and often palpi, are rufous; the female frons (Figure 1C) averages a little narrower with triangular callosity tapered moderately above into the median callus, and the upper area of enlarged facets of male eyes (Figure 1D) are more reduced, than in the typical form (Figures 1A and B). The holotype and allotype are in the author's collection.

This is a large reddish-brown variety with red-haired appendages, strongly excised antennal plates, and subhyaline wings with infuscated costal cells and isolated clouds on the cross-veins.

Holotype Female: 22 mm. Eyes bare. Frons parallel-sided, buff-yellow, paler below and darker above in certain lights, with short yellow and brown hairs; callosity, median line, and an evanescent spot at vertex deep red, the first subtriangular, narrowly separated from the eyes below, with a pair of small lateral indentations on lower margin. Subcallus and outer cheeks yellow, an irregular, bare orange band across the top and continuous with the callosity. Face and inner cheeks buff with brown hairs. Beard brown. Antennae and palpi orange, shaped as figured, hairs rufous.

Notum red-brown, scutellum red, indistinctly lined anteriorly with gray pollen, hairs short, yellow and black. Pleura pinkish gray, bi-colored; tufts of brown and pale yellow pile beneath, and pale tufts behind, the wing bases. Legs red; fore tibiae unicolorous red, not darker-haired apically; hind-tibial fringe prominent, entirely deep red. Alula and squamae smoky. Subepaulets red-haired in contrast to black-haired costa. Halteres yellow with red stems.

Abdomen red-brown, covered with appressed black hairs, a median row of small whitish, white-haired triangles on all but the last tergites and patches of white hairs on the outer corners of 2-4. Venter entirely pale-haired, accentuated on the incisures; a few black hairs mesally and caudally.

"Gunntown," Levy Co., Fla., 1918, P. Laurent (no such post office now listed). From Dr. K. L. Hays, Auburn University.

Allotype Male: 19 mm. In close agreement with the holotype and readily associated, except for the usual sexual differences. The brown pile on cheeks extends upward to base of antennae. Palpi long ovoid, black-haired. Dark-haired patches on pleura larger than in holotype. Hairs on femora and coxae predominantly blackish. Body with some darker integumental shades, and a small dark triangle behind the scutellum, the dorsal,

[1] U. S. Department of Health, Education, and Welfare, Public Health Service, National Institutes of Health, National Institute of Allergy and Infectious Diseases, Rocky Mountain Laboratory, Hamilton, Montana.

abdominal pale-haired patches less conspicuous. Pale hairs of venter confined to incisures, elsewhere mixed red and black. Alachua Co., Fla., 18.v.28, Alexander-Walker.

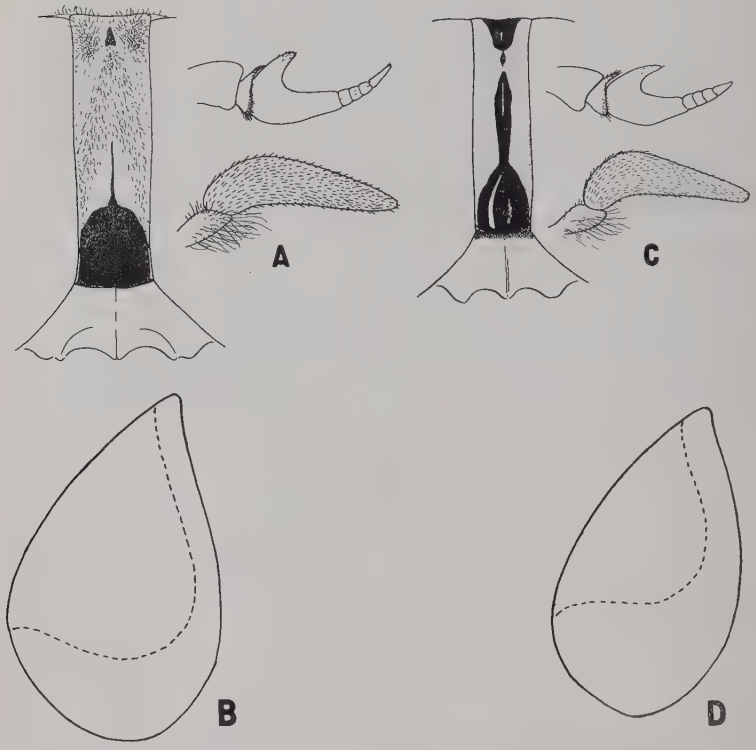


Figure 1.—Fronts, antennae and palpi of females of: A. *Tabanus imitans* var. *imitans* Walker (Umstead St. Park, North Carolina), and C. *T. imitans* var. *pechumani* nov. (Pasco Co., Florida).

Comparison in outlines of upper areas of enlarged facets of respective males, B. (Lake Placid, Florida) and D. (allotype).

PARATYPES (MALES): *Georgia*, Waycross, 8.v.33, P. W. Fattig (Emory Univ. Coll.). *Florida*, Gainesville, 13.v.19, P. W. Fattig (Coll. L. L. Pechuman); Georgiana, Wm. Whitfield, and "Fla. Palm"; Coll. J. M. Aldrich (U. S. National Museum); Alachua Co., May, 1958, F. S. Blanton.

(FEMALES): *Georgia*, Longwood, 23.iii.35, F. E. Lutz; St. Simon Isl., 22.iv to 12.v.11, J. C. Bradley; 7, Fargo, 3.v.35, and 10, Okeefinokee, Clinch Co., 4-6.v.35, D. G. Hall. *Florida*, one, same data as holotype; 8, Gainesville, various dates Apr. and May, P. W. Fattig, C. M. Jones and D. W. Anthony (3 off cow, horse and man); eight, Alachua Co., 31.v. and May. 58, W. P. Hunter and F. S. Blanton; one, Alachua Co., 29.iv.57, Malphurs;

two, Alachua Co., May 1954, Clements; one, Gulf Hammock (Levy) 17.v.57, Clements; 33 from various counties, Volusia, Brevard (Illaha, Indian River, and Melbourne), Seminole (Goldenrod), St. Johns (St. Augustine), Pinellas (Pas-a-grille and Tarpon Springs), Columbia (Lake City), Pasco (Elfers), Indian River (Vero), Marion (Silver Springs), Hillsborough (Plant City and Tampa), Dade (Miami), Bay, Hernando, Manatee (Oneco), and Charlotte (Charlotte Harbor) on various dates from 19 March to 31 May by various collectors; one each from: Ft. Reed, 26.iii.1876, Highland Hammock St. Park, 20.iii.57 (H. Dietrick), Parker Is., 25.iii.59 ("Ac"), and "Cor. Fla., Apr.," (O. S. Wescott). In the collections of U. S. National Museum (including the topotypic female), Canadian National Collection, American Museum of Natural History, Cornell University and University of Florida, Florida State Plant Board, K. L. Hays, L. L. Pechuman, Calvin Jones, and the writer. Records thus extend over the entire state of Florida except for the northern "panhandle".

The general color varies from more over-all reddish, especially in worn specimens, to deep brown with heavier wing markings basally compared to the holotype. Two females from Florida and one from Georgia have predominantly black-haired beards, pleura and fore coxae, but the hairs of the tibiae and subepaulets are dark red as in the other paratypes. No females have the broader callosities nor males the more extensive enlarged facets of the typical form. It is likely that the frons and callosity figured by Stone (1938) were drawn from a specimen of this variety. A paratype female with characteristic callosity and red vestiture was taken at Gainesville, Florida, by P. W. Fattig within 10 days of a female of typical variety *imitans* with broader callosity, and mostly white hairs in beard and on appendages.

For comparison with these are 18 males and 41 females from various southeastern coastal states including a considerable series of both sexes from Lake Placid, Florida, in the collections of Cornell and L. L. Pechuman. Some of these females have entirely white hind-tibial fringes; in others the fringes vary from mixed black and white to entirely black in a few North Carolina, Florida, Mississippi, and Texas females. Four darker females from Bratt, Florida, one each from Alabama, Lucedale and Ocean Springs, Mississipi, and Fred, Texas, appear to lack the median row of pale-haired triangles (not because of wear), and one from Raleigh, North Carolina, has these reduced to a few inconspicuous hairs on only three tergites. These triangles are less conspicuous in most males.

Intergradations occur in a few other North Carolina specimens with black-haired tibiae and subepaulets. A male from Kill Devil Hills has the small facets and three females from there have triangular callosities similar to new variety *pechumani*. A fourth female taken earlier in May in the same locality has the typical subquadrate callosity, and is the only specimen in the entire series with mixed black and rufous hairs on the subepaulets and hind-tibial fringe. One male from Gainesville has the smaller facets but black-haired tibial fringe and subepaulets.

In spite of these few variants, var. *pechumani* is readily distinguished in the bulk of material on hand or studied at USNM, and Emory University (Fattig Collection).

The differences of var. *excessus* are consistent in combination of non-hooked antennal plates, hind-tibial fringes mostly red but darker apically,

subepaulets black-setulose, wings with clouds intensified, and, in females, callosities broadly ovoid. The enlarged upper eye facets of males are extensive as in the typical form. The only specimen with antennae intermediate between the typical form, and var. *excessus* is a male from Lake Placid, Florida, which is otherwise typical *imitans*. The allotype male of *excessus* was described by Philip (1954) from Alachua Co., Florida, and, while in press, this sex was redescribed by Pechuman (1955).

I saw the respective types of *T. imitans* Walker and *T. fuscopunctatus* Macquart in British and Paris Museums in 1953, but was not then aware of present variation. However, subsequent information on these types supplied by Mr. H. Oldroyd and Professor Seguy has confirmed the synonymy.

Variation had also been noticed by Dr. L. L. Pechuman (1955). It is a pleasure to name this variety for him, who has shared both his extensive knowledge of Nearctic Tabanidae and much exotic material.

Literature Cited

Pechuman, L. L. 1955. Some undescribed or little known males of Tabanidae (Diptera). Bull. Brooklyn Ent. Soc., 50: 57-69.

Philip, C. B. 1954. New North American Tabanidae (Diptera). VI. Descriptions of Tabaninae and new distributional data. Ann. Ent. Soc. Amer., 47: 25-33.

Stone, A. 1938. The horseflies of the subfamily Tabaninae of the Nearctic Region. U. S. Dept. of Agri., Misc. Publ. No. 305, pp. 1-172.

Supplemental Note to Part X

The following catalog information regarding lectotype establishment should have been included in Part X (Philip, 1959, Trans. Amer. Ent. Soc., 85: 193-217): *Diabasis ataenia* Macquart is generally credited as a synonym of *Diachlorus ferrugatus* Fabricius and to preserve this concept, one of two syntypes in the Paris Museum seen in 1953 from "Carolinie," and labelled by Macquart "ataeniata," is herewith designated lectotype. The other from Brazil is a different species. Of the original three syntypes of *T. vicarius* Walker in the British Museum, only one from "North America" agrees with assignment in Part X as synonym of *T. nigrovittatus* Macquart, and is designated lectotype. The "Honduras" syntype is now missing, and the "Mass." syntype is a specimen of *T. similis* Macquart (syn. *scutellaris* Walker).

THE GENUS *BREVIPALPUS* IN MEXICO, PART I (ACARINA: TENUIPALPIDAE)[1]

DONALD DE LEON
Erwin, Tennessee

Mites of the genus *Brevipalpus* feed on plants and several of them are important economically.

All of the *Brevipalpus* described in Part I of this paper belong to the species group with 6 pairs of dorsolateral hysterosomals, 2 setae on the last segment of the palpus, and tarsus II of the female with 1 sensory rod. Except for the first species, *hypti*, all have the anterior medioventral metapodosomals much shorter than the posterior pair and in the first 6 species the rostrum extends beyond the distal end of femur I; in the others the rostrum does not extend beyond the distal end of femur I. Except as noted, the tarsal claws have distinct hooks. These characters will not be repeated in the individual descriptions.

All measurements are in microns and body length includes the rostrum. The drawings of the nymphs are of the deutonymphal stage unless otherwise stated.

Brevipalpus hypti, n. sp.

(Figures 1A and 1B)

Brevipalpus hypti resembles *B. salviae* McG. (1949) in having long plumose dorsolateral setae, but differs from that species in having the dorsocentrals shorter and the areolae of the dorsum much smaller.

FEMALE: Body reddish, dorsal setae white; body length 284, width 157. Markings of dorsum and shapes of dorsal setae as shown in figure 1A; venter smooth medially except for ventral plate with distinct areolae (in some specimens areolae longer than wide, in others small and round) and genital plate with areolae wider than long.

MALE: Resembles female, but rostrum extends barely beyond distal end of femur I, the 4 pairs of posterior dorsolateral hysterosomals are proportionally longer, and tarsus II has 2 sensory rods.

NYMPH: Shapes of dorsal setae as shown in figure 1B.

Holotype: Female, Ixtlan del Rio, Nayarit, March 24, 1957, (D. De Leon) from *Hyptis albida*. *Paratypes*: 5 females, 2 males, other data as for holotype; 4 females, 1 nymph, Guadalajara, Jalisco, March 22, 1957, from same host species.

Brevipalpus quercicolus, n. sp.

(Figures 2A and 2B)

The female of *Brevipalpus quercicolus* is distinguished from other members of this subgroup by its having the dorsum very finely reticulate. The male is not known.

FEMALE: Length 253, width 135; reticulations of the dorsum and shapes of dorsal setae as shown in figure 2A. Venter smooth medially except for

[1] This work has been aided by a grant from the Sigma Xi—RESA Research Fund.

genital plate which bears faint polygonal reticulations. Tarsal claws without hooks.

NYMPH: Shapes of dorsal setae as shown in figure 2B. Tarsal claws with hooks.

Holotype: Female, near km post 134, route 71, Mex., March 10, 1957, (D. De Leon) from *Quercus* sp. *Paratypes*: 2 females, 3 nymphs, other data as for holotype.

Brevipalpus pseudoleptoides, n. sp.

(Figures 3A and 3B)

Brevipalpus pseudoleptoides is distinguished from other members of this subgroup by its elongate body.

FEMALE: Length 271-318, width 126 to 139; markings of dorsum and shapes of dorsal setae as shown in figure 3A; rostrum extends to distal end of genu I. Venter practically smooth except for genital plate with areolae much wider than long.

MALE: Resembles female, but tarsus II with 2 sensory rods.

NYMPH: Shapes of dorsal setae as shown in figure 3B.

Holotype: Female, near km post 681, route 190, Oaxaca, January 31, 1957, (D. De Leon) from *Dodonea viscosa*. *Paratypes*: 6 females, 1 male, 1 nymph, Etla, Oax., February 1, 1957, from *Dodonea viscosa*.

Brevipalpus serratus, n. sp.

(Figures 4A and 4B)

B*revipalpus serratus* is distinguished from other members of this subgroup by its having strongly serrate dorsal setae and the areolae of the disk of the hysterosoma transversely coalesced. The male is not known.

FEMALE: Length 349, width 177. Markings of dorsum and shapes of dorsal setae as shown in figure 4A. Ventral plate smooth medially with small rounded areolae at sides, genital plate with transverse striae.

NYMPH: Shapes of dorsal setae as shown in figure 4B.

Holotype: Female, Tuxtla Gutierrez, Chiapas, January 21, 1957, (D. De Leon) from an unknown tree. *Paratypes*: 3 nymphs, other data as for holotype.

Brevipalpus lagasceae, n. sp.

(Figures 5A and 5B)

The female of *Brevipalpus lagasceae* resembles *B. crotoni*, n. sp., but the rostrum extends farther forward, both setae of the palptarsus are of about the same length, and the dorsal setae of the body are oval.

FEMALE: Body bright red, length 342, width 174. Markings of dorsum and shapes of dorsal setae as shown in figure 5A. Venter smooth medially except for ventral and genital plates which have areolae wider than long.

MALE: Resembles female, but dorsal setae somewhat longer proportionally and tarsus II has 2 sensory rods.

NYMPH: Shapes of dorsal setae as shown in figure 5B.

Holotype: Female, Arenal, Jalisco, March 24, 1957, (D. De Leon) from *Lagascea angustifolia*. *Paratypes*: 6 females, 2 males, 1 nymph, other data as for holotype.

Brevipalpus crotoni, n. sp.
(Figures 6A, 6B, and 6C)

Brevipalpus crotoni resembles *B. essigi* Baker (1949), but differs most notably in having one of the setae of the terminal segment of the palpus much shorter than the other and the male with 2 sensory rods on tarsi I and II.

FEMALE: Length 275, width 156; markings of dorsum and shapes of dorsal setae as shown in figure 6A. Venter smooth medially except for ventral plate with areolae wider than long and the genital plate with areolae about as wide as long.

MALE: Resembles female, but tarsi I and II each with 2 sensory rods.

NYMPH: Shapes of dorsal setae as shown in figure 6B.

Holotype: Female, Ciudad Victoria, Tam., June 12, 1957, (D. De Leon) from *Croton ciliato-glandulosus*. *Paratypes*: 3 females, 1 male, and 1 nymph, other data as for holotype.

Brevipalpus tuberellus, n. sp.
(Figures 7A and 7B)

Brevipalpus tuberellus belongs to the *floridianus-fleschneri* subgroup, but differs from these 2 species in having the dorsum tuberculate mediolaterally.

FEMALE: Length 317 to 344, width 190 to 204. Markings of dorsum and shapes of dorsal setae as shown in figure 7A. Venter covered medially with small, rounded areolae except for a smooth area between and just posterior of anterior medioventrals and for genital plate with areolae wider than long.

MALE: Resembles female, but tubercles of dorsum reduced, dorsocentral hysterosomals setiform, and tarsus II with 2 sensory rods.

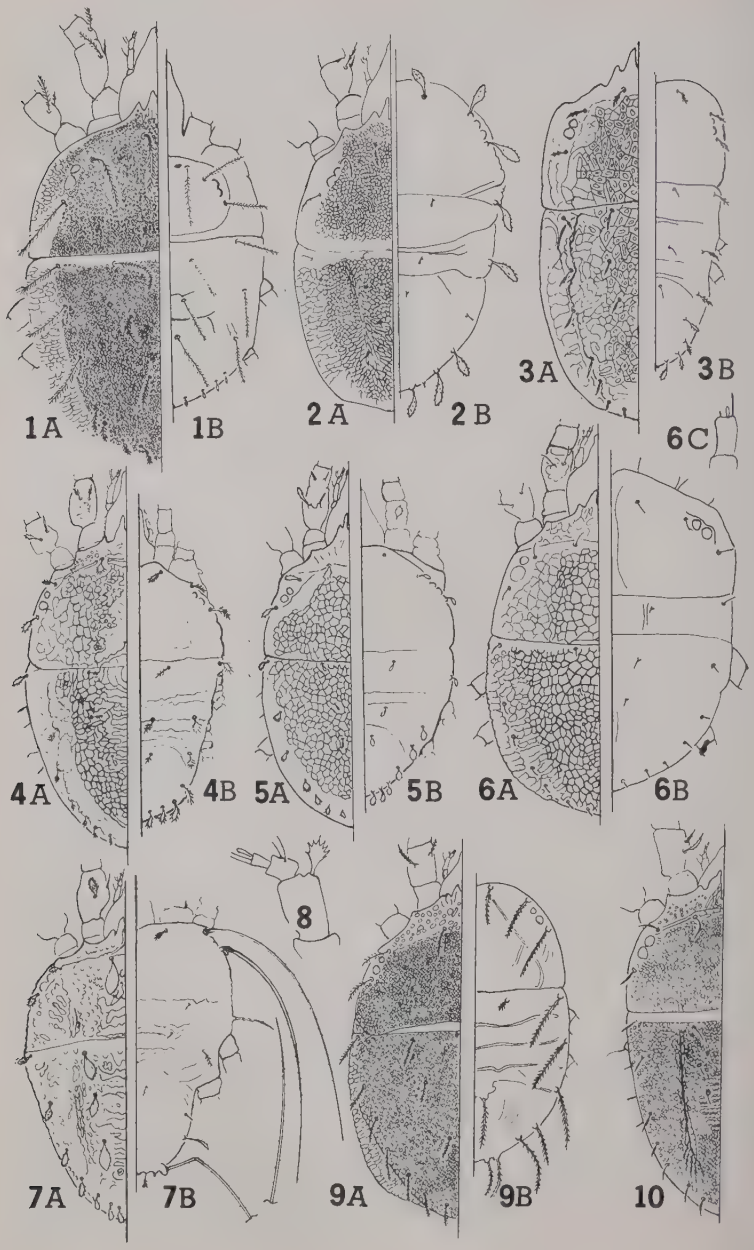
NYMPH: Shapes of dorsal setae as shown in figure 7B. The lengths of the humeral and first 3 dorsolateral hysterosomals vary somewhat between individuals.

Holotype: Female, near Antiguo Morelos, Tam., December 20, 1956, (D. De Leon) from *Phoebe tampicensis*. *Paratypes*: 3 females, 2 males, 3 nymphs, other data as for holotype. Specimens which vary somewhat from the types, but probably belong here were collected near Matias Romero, Oax., from *Phoebe mexicana*; at Santa Maria del Oro, Nay., from an unknown lauraceous tree, and at San Blas, Nay., from *Nectandra tabascensis*.

Brevipalpus formosus, n. sp.
(Figure 8)

The female of *B. formosus* resembles *tuberellus* closely in dorsal markings, but is smaller and the seta of the second palpal segment is palmate. The male and nymph are unkown.

FEMALE: Body dark red; legs, rostrum, and hysterosomal setae white; length of body 271, width 172. Dorsum with low tubercles mediolaterad and at sides of body; disk of propodosoma smooth except for scattered small sunken areas or pits; disk of hysterosoma with transverse ridges


1A
1B
2A
2B
3A
3B
6C
4A
4B
5A
5B
6A
6B
8
7A
7B
9A
9B
10

posteriad. Venter with rounded areolae medially except for ventral plate which is closely more or less transversely striate and genital plate which has areolae somewhat longer than wide. Dorsal surface of legs with small circular raised areas.

Holotype: Female, Aticama, Nay., April 8, 1957, (D. De Leon) from *Licaria* sp. *Paratypes*: 4 females, other data as for holotype.

Brevipalpus chucumayi, n. sp.

(Figures 9A and 9B)

The female of *Brevipalpus chucumayi* may be distinguished by its short rostrum, plumose dorsolaterals, and finely areolate dorsum. The male is not known.

FEMALE: Body dirty white, length 266, width 165. Markings of dorsum and shapes of dorsal setae as shown in figure 9A. Venter smooth medially anterior of posterior metapodosomals, with small rounded areolae between these setae and anterior part of frame of ventral plate which is wide and with 3 transverse striae; ventral plate with small rounded to somewhat elongate areolae; genital plate with areolae much wider than long; anterior metapodosomals about 20 long, posterior pair about 65 long. Tarsal claws with very small hooks.

NYMPH: Shapes of dorsal setae as shown in figure 9B; dorsocentral 2 is missing.

Holotype: Female, Trinidad, Oax., January 26, 1957, (D. De Leon) from *Styrax argentata*. *Paratypes*: 2 females, 1 nymph, other data as for holotype.

Brevipalpus albus, n. sp.

(Figure 10)

Brevipalpus albus is allied to *B. ogmus* Pritchard and Baker (1952); it differs from that species in having smaller, more rounded areolae, in lacking hooks on the claws, and in other characters. The male and nymph are not known.

FEMALE: Body dirty white; length 262, width 135; markings of dorsum and shapes of dorsal setae as shown in figure 10. Venter smooth medially except for genital plate which has small oval areolae slightly wider than long. Tarsal claws without hooks.

Holotype: Female, Santa Maria del Oro, Nay., March 24, 1957, (D. De Leon) from *Quercus aristata*. *Paratypes*: 11 females, other data as for holotype.

Plate 1

Figures 1A and 1B.	*Brevipalpus hypti*, n. sp.
Figures 2A and 2B.	*Brevipalpus quercicolus*, n. sp.
Figures 3A and 3B.	*Brevipalpus pseudoleptoides*, n. sp.
Figures 4A and 4B.	*Brevipalpus serratus*, n. sp.
Figures 5A and 5B.	*Brevipalpus lagasceae*, n. sp.
Figures 6A, 6B, and 6C.	*Brevipalpus crotoni*, n. sp.; 6C, palpus.
Figures 7A and 7B.	*Brevipalpus tuberellus*, n. sp.
Figure 8.	*Brevipalpus formosus*, n. sp., palp of female.
Figures 9A and 9B.	*Brevipalpus chucumayi*, n. sp.
Figure 10.	*Brevipalpus albus*, n. sp., female.

Brevipalpus oreopanacis, n. sp.
(Figures 11A and 11B)

The female of *Brevipalpus oreopanacis* resembles that of *B. chucumayi*, but differs most noticeably from that species by having the rostral shield and the anterior margin of the propodosoma with only a few scattered striae, and the tarsal claws with large hooks.

FEMALE: Body white; length 305, width 182; markings of dorsum and shapes of dorsal setae as shown in figure 11A. Venter smooth medially except for the wider than long areolae on the area posterior of the posterior pair of metapodosomals, and on the ventral and genital plates.

MALE: Resembles female, but tarsus II with 2 sensory rods.

NYMPH: Shapes of dorsal setae as shown in figure 11B.

Holotype: Female, Santa Maria del Oro, Nay., March 24, 1957, (D. De Leon) from *Oreopanax peltata*. *Paratypes*: 3 females, 2 males, 1 nymph, other data as for holotype.

Brevipalpus insinuatus, n. sp.
(Figures 12A and 12B)

Brevipalpus insinuatus resembles *B. ogmus* P. & B. (1952), but differs from that species in having a mediolateral depression on the propodosoma and in having propodosomal 1 broadly oval.

FEMALE: Length 284, width 156; markings of dorsum and shapes of dorsal setae as shown in figure 12A. Areolae of venter broader than wide.

MALE: Resembles female, but areolae appear to be missing in places from the disk of the propodosoma giving it a pitted appearance, and tarsus II with 2 sensory rods.

NYMPH: Shapes of dorsal setae as shown in figure 12B.

Holotype: Female, Tuxtla Gutierrez, Chiapas, January 15, 1957, (D. De Leon) from *Quercus* sp. *Paratypes*: 3 females, 1 male, 1 nymph, other data as for holotype. Additional specimens were collected from *Quercus laurina* near km post 277 east of Morelia, Mich.

Brevipalpus ewpristori, n. sp.
(Figures 13A and 13B)

The female of *Brevipalpus ewpristori* resembles *B. essigi* Baker (1949), but the venter of *ewpristori* is almost completely covered with small rounded areolae. The nymph is also distinctive.

FEMALE: Length 348 to 365, width 181 to 199; markings of dorsum and shapes of dorsal setae as shown in figure 13A. Most of venter includ-

---

Plate 2

Figures 11A and 11B. *Brevipalpus oreopanacis*, n. sp.
Figures 12A and 12B. *Brevipalpus insinuatus*, n. sp.
Figures 13A and 13B. *Brevipalpus ewpristori*, n. sp.
Figures 14A and 14B. *Brevipalpus oaxacensis*, n. sp.
Figures 15A and 15B. *Brevipalpus perseae*, n. sp.
Figures 16A and 16B. *Brevipalpus filifer*, n. sp.
Figures 17A and 17B. *Brevipalpus alni*, n. sp.

11A
11B
12A
12B
15A
13A
13B
14A
14B
15B
16A
16B
17B
17A

ing ventral plate covered with small, rounded areolae, genital plate with reticulations wider than long.

MALE: Resembles female, but tarsus II with two sensory rods.

NYMPH: Shapes of dorsal setae as shown in figure 13B.

Holotype: Female, Jalapa, Ver., March 3, 1957, (D. De Leon) from *Baccharis conferta*. *Paratypes*: 3 females, 3 males, 5 nymphs, other data as for holotype. Additional specimens were collected from an unknown host, same locality as for holotype and from *Fuchsia* sp. and *Senecio aschenborneanus*, June 5, 1957, near km post 258 east of Morelia, Mich.

Brevipalpus oaxacensis, n. sp.

(Figures 14A and 14B)

The female of *Brevipalpus oaxacensis* resembles *B. sayedi* Baker (1949) in the reticulations of the dorsum, but the lack of markings on most of the venter of *oaxacensis* is distinctive.

FEMALE: Length 266, width 142; markings of dorsum and shapes of dorsal setae as shown in figure 14A. Venter smooth medially except genital plate which has large, polygonal reticulations.

MALE: Resembles female, but areolae of propodosoma and metapodosoma smaller and more rounded and tarsus II with 2 sensory rods.

NYMPH: Shapes of dorsal setae as shown in figure 14B.

Holotype: Female, Oaxaca, Oax., February 1, 1957, (D. De Leon) from *Quercus conzatii*. *Paratypes*: 12 females, 3 males, 3 nymphs, other data as for holotype.

Brevipalpus perseae, n. sp.

(Figures 15A and 15B)

Brevipalpus perseae belongs in the *floridianus-fleschneri* group, but is distinguished from those species by its much narrower dorsocentrals.

FEMALE: Length 288 to 322, width 172 to 244. Dorsum strongly ridged medially, its markings and the shapes of the dorsal setae as shown in figure 15A. Metapodosoma with small rounded areolae except for smooth oval area beteen metapodosomals; ventral plate with small rounded areolae, genital plate with areolae wider than long.

MALE: Resembles female, but dorsocentrals setiform and tarsus II with 2 sensory rods.

NYMPH: Shapes of dorsal setae as shown in figure 15B.

Holotype: Female, Tepic, Nay., March 25, 1957, (D. De Leon) from *Persea hintoni*. *Paratypes*: 3 females, 3 males, 3 nymphs, other data as for holotype.

Brevipalpus filifer, n. sp.

(Figures 16A and 16B)

The female of *Brevipalpus filifer* may be distinguished from other members of the group by its rather long, very slender dorsolateral setae and the very broad anterior part of the frame of the ventral plate.

FEMALE: Length 266 to 280, width 159; markings of dorsum and shapes of dorsal setae as shown in figure 16A. Venter smooth medially anterior of posterior metapodosomals, reticulations between these setae and an-

terior part of frame of ventral plate coarsely reticulate, anterior part of frame of ventral plate very wide, composed of 4 to 5 smooth bands. Ventral and genital plates with areolae wider than long.

MALE: Resembles female, but tarsus II with 2 sensory rods.

PROTONYMPH: Shapes of dorsal setae as shown in figure 16B.

Holotype: Female, near San Cristobal, Chiapas, January 22, 1957, (D. De Leon) from *Persea schideana*. *Paratypes*: 5 females, 1 male, 1 nymph, other data as for holotype.

Brevipalpus alni, n. sp.
(Figures 17A and 17B)

Brevipalpus alni resembles *B. delus* P. & B. (1952), but differs from that species most noticeably by the areolae of the hysterosoma being longer than wide in the mediolateral area. The male is not known.

FEMALE: Length 272, width 165; markings of dorsum and shapes of dorsal setae as shown in figure 17A. Venter of metapodosoma covered with rounded areolae except for smooth, oval area between metapodosomals; ventral plate with rounded areolae, genital plate with areolae wider than long.

NYMPH: Shapes of dorsal setae as shown in figure 17B.

Holotype: Female, near San Cristobal, Ch., January 22, 1957, (D. De Leon) from *Alnus arguta*. *Paratypes*: 1 female, 2 nymphs, other data as for holotype.

Brevipalpus striatus, n. sp.
(Figures 18A and 18B)

The female of *Brevipalpus striatus* is distinguished by the striate mediolateral area of the propodosoma and the hysterosoma and the deep mediolateral groove of the later. The male is unknown.

FEMALE: Length 290, width 153; markings of dorsum and shapes of dorsal setae as shown in figure 18A. Venter smooth medially anterior of posterior metapodosomals, area between these setae and frame of ventral plate with areolae wider than long; ventral and genital plates with areolae wider than long.

NYMPH: Shapes of dorsal setae as shown in figure 18B.

Holotype: Female, Trinidad, Ch., January 26, 1957, (D. De Leon) from "mata gusano", a large tree. *Paratype*: 1 female, other data as for holotype.

Brevipalpus levis, n. sp.
(Figures 19A and 19B)

Brevipalpus levis resembles *B. xystus* P. &. B. (1958), but is distinguished from this species by having a nearly smooth dorsum with shallow pits on the disk of the propodosoma and oval dorsolaterals.

FEMALE: Dark reddish brown; length 290, width 154. Markings of dorsum and shapes of dorsal setae as shown in figure 19A. Venter smooth medially anterior of posterior metapodosomals, area between these setae and frame of ventral plate with areolae wider than long; ventral plate with mostly rounded areolae, the others wider than long; genital plate with areolae wider than long.

PROTONYMPH: The shapes of dorsal setae as shown in figure 19B.

Holotype: Female, Veracruz, Ver., December 25, 1956, (D. De Leon) from *Cordia glabra*. *Paratypes*: 3 females, 2 nymphs, other data as for holotype. Additional specimens were collected in the same locality February 19, 1957, from an unknown tree.

Brevipalpus rugosus, n. sp.

(Figure 20)

Brevipalpus rugosus is distinguished by the rugose surface of the mediolateral area of the propodosoma and the rather long, narrow-elliptic dorsolateral setae. The nymph is unknown.

FEMALE: Length 289 to 308, width 163 to 172; markings of dorsum and shapes of dorsal setae as shown in figure 20. Venter smooth medially anterior of posterior metapodosomals, area between these setae and frame of ventral plate with both rounded and wider than long areolae; ventral plate with areolae much wider than long; genital plate with both rounded and wider than long areolae.

MALE: Resembles female, but dorsum not as rugose and tarsus II with 2 sensory rods.

Holotype: Female, Nochitlan, Oax., February 1, 1957, (D. De Leon) from *Quercus magnoliaefolia*. *Paratypes*: 7 females, 1 male, other data as for holotype.

Brevipalpus mori, n. sp.

(Figures 21A and 21B)

Brevipalpus mori is distinguished by the pits on the disk and the nearly smooth mediolateral area of the propodosoma. The male is not known.

FEMALE: Length 282, width 154; marking of dorsum and shapes of dorsal setae as shown in figure 21A. Venter medially with rounded areolae from about half way between anterior and posterior medioventrals to frame of ventral plate; ventral and genital plates with areolae wider than long.

NYMPH: Shapes of dorsal setae as shown in figure 21B.

Holotype: Female, Trinidad, Oax., January 26, 1957, (D. De Leon) from *Morus alba*. *Paratypes*: 4 females, 1 nymph, other data as for holotype.

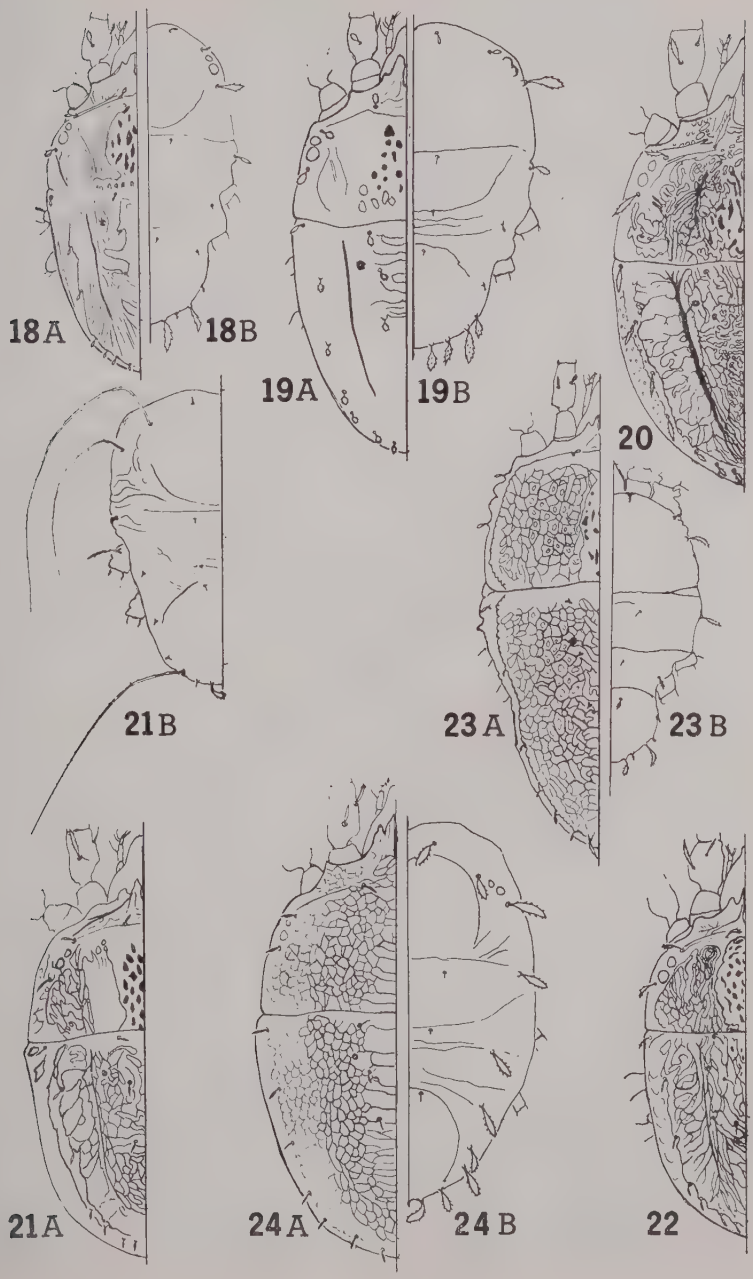
Brevipalpus variolatus, n. sp.

(Figure 22)

The female of *Brevipalpus variolatus* is distinguished by its small size, by the somewhat raised disk of the propodosoma with numerous small pits and the serrate propodosomals. The male and nymph are unknown.

Plate 3

Figures 18A and 18B. *Brevipalpus striatus*, n. sp.
Figures 19A and 19B. *Brevipalpus levis*, n. sp.
Figure 20. *Brevipalpus rugosus*, n. sp., female.
Figures 21A and 21B. *Brevipalpus mori* n. sp.
Figure 22. *Brevipalpus variolatus*, n. sp., female.
Figures 23A and 23B. *Brevipalpus testudinalis*, n. sp.
Figures 24A and 24B. *Brevipalpus religiosae*, n. sp.


18A
18B
19A
19B
20
21B
23A
23B
21A
24A
24B
22

FEMALE: Length 259, width 136; markings of dorsum and shapes of dorsal setae as shown in figure 22. Venter smooth medially anterior of posterior metapodosomals, between these seta and anterior frame of ventral plate areolae wider than long; ventral and genital plates with areolae wider than long.

Holotype: Female, Trinidad, Ch., January 18, 1957, (D. De Leon) from *Ceiba acuminata*. *Paratypes*: 10 females, other data as for holotype. The tree was without leaves and the mites were in groups of 5 to 10 on the buds in among the coarse hairs.

Brevipalpus testudinalis, n. sp.
(Figures 23A and 23B)

The elongate body and the raised margin of the dorsum is distinctive for *B. testudinalis*.

FEMALE: Dirty white; length 282, width 159; markings of dorsum and shapes of dorsal setae as shown in figure 23A. Metapodosoma areolate except for smooth oval area between anterior and posterior metapodosomals, areolae much longer than wide except towards frame of ventral plate where areolae are mostly rounded; ventral plate with narrow areolae directed posteromedially; genital plate with areolae slightly wider than long and somewhat polygonal.

MALE: Resembles female, but tarsi I and II each with 2 sensory rods. Second segment of palp with seta nearly as long as that of female's.

PROTONYMPH: Shapes of dorsal setae as shown in figure 23B.

Holotype: Female, San Blas, Nay., April 23, 1957, (D. De Leon) from an unknown tree. *Paratypes*: 9 females, 2 males, 3 nymphs, other data as for holotype.

Brevipalpus religiosae, n. sp.
(Figures 24A and 24B)

Brevipalpus religiosae is distinguished by its large size, by having the median ridge with broad coalesced areolae and the mediolateral area with large polygonal reticulations.

FEMALE: Length 398, width 220; markings of dorsum and shapes of dorsal setae as shown in figure 24A. Metapodosoma with small rounded areolae between coxal bases and metapodosomals and extending to frame of ventral plate where areolation meets at center. In some specimens areolae cover metapodosoma except for small oval area between the metapodosomals, and in some specimens areolae in clusters. Anterior part of frame of ventral plate composed of 2 to 4 bands; ventral plate with small rounded areolae, genital plate with areolae wider than long.

MALE: Resembles female, but tarsus II with 2 sensory rods.

NYMPH: Shapes of dorsal setae as shown in figure 24B.

Holotype: Female, east of Morelia, Mich., near km post 270, route 15, June 5, 1957, (D. De Leon) from *Abies religiosa*. *Paratypes*: 2 females, 1 male, 4 nymphs, near Mexico, D. F., March 10, 1957, from same host species. Additional specimens were collected from *Pinus* sp. near San Cristobal, Chiapas.

Brevipalpus essigi Baker and *B. russulus* (Boisduval) belong in the species group treated in this paper and are recorded from Mexico by Pritchard and Baker (1958), but were not collected by the writer.

Types of the above new species are in the author's collection; paratypes will be deposited in the University of Florida Collections, Gainesville.

Explanation of Figures

The drawings are of the dorsal halves of the adult females, indicated by the letter A and of the dorsal halves of the nymphs, indicated by the letter B.

Acknowledgments

I wish to thank the following botanists for the identification of plants: Mr. Miguel Palacios Rincon, Instituto de Historia Natural de Chiapas, for those in the region round Tuxtla Gutierrez; Dr. Rogers McVaugh, University of Michigan, for those of Jalisco and Nayarit, and Dr. Faustino Miranda, Instituto de Biologia, Casa del Lago, Mexico, D. F., for those from other parts of Mexico.

Literature Cited

Baker, E. W. 1949. The genus *Brevipalpus* (Acarina: Pseudoleptidae). Amer. Mid. Nat. 42(2): 350-402.

McGregor, E. A. 1949. Nearctic mites of the family Pseudoleptidae. Mem. So. Calif. Acad. Sc. 3(2): 1-45.

Pritchard, A. E., and *E. W. Baker.* 1952. The false spider mites of California (Acarina: Phytoptipalpidae). Univ. Calif. Publ. Ent. 9(1): 1-91.

Pritchard, A. E., and *E. W. Baker.* 1958. The false spider mites (Acarina: Tenuipalpidae). Univ. Calif. Publ. Ent. 14(3): 175-274.

Bees of the Eastern United States, Volume I, by Theodore B. Mitchell. 1960. N. C. Agr. Exp. Sta., Tech. Bul. 141, 538 p., illus. Price $10.00. This is the first of two volumes covering the bee fauna of the United States east of the Mississippi River. It treats the families Colletidae, Andrenidae, Halictidae, and Melittidae with 92 new species and subspecies described. The general introduction includes the materials and methods, ecology, morphology, and classification, as well as a key to the eight families recognized. All 437 species described in the text can be determined through the generic keys. The double column format, as well as the organization of the material, make the volume particularly easy to use. All illustrations are line drawings, prepared to show characteristics that are useful in distinguishing species treated in the volume. The book is an outstanding contribution to entomology by its consolidation and updating of information about bees and it will be a boon to specialist and student alike. Dr. Mitchell is to be congratulated on the publication of this first volume and its users will certainly look forward to the early appearance of Volume II.—L. B.

NEW FACES FOR '60

TALL, HEALTHY carrots, celery and asparagus, luscious red tomatoes, leafy lettuce, big solid potatoes—all presenting fresh, happy faces for '60—a tribute to America's up-to-date agricultural methods. Today, modern farmers are increasing both yields and quality by utilizing the very latest techniques available.

Shell Chemical Company, in cooperation with federal, state and local agricultural specialists, is continually striving to help farmers reach higher agricultural goals. Result: products like aldrin, dieldrin, endrin, methyl parathion, and Phosdrin® insecticides; D-D® and Nemagon® soil fumigants; Aqualin* aquatic herbicide and allyl alcohol for weed seed control in seed beds.

The never-ending search for superior products to help grow bigger and better crops is a welcome assignment to Shell Chemical Company—chemical partner of agriculture and industry.

SHELL

SHELL CHEMICAL COMPANY

AGRICULTURAL CHEMICALS DIVISION
110 West 51st Street, New York 20, New York

FIELD TESTS WITH NEW TICK REPELLENTS IN 1955, 1956, AND 1959

H. K. Gouck, and I. H. Gilbert [1]
Entomology Research Division, A.R.S., U.S.D.A.

Field tests were conducted near Richmond Hill, Georgia, during the springs of 1955, 1956, and 1959, in areas heavily infested with nymphs and adults of the lone star tick (*Amblyomma americanum* [L.]). Aging tests were run in all these years, and in 1956 two series of wear tests were also conducted, one in cooperation with the 714th Medical Company (Preventive), U. S. Army, at Fort Stewart, Georgia, and the other at Richmond Hill.

The repellents were selected on the basis of their performance in laboratory screening tests. The studies that preceded this work have been reported by Smith et al. (1946, 1948, 1949, 1954), Cole et al. (1950), and Gouck et al. (1955). The repellents were cleared for limited experimental use as clothing impregnants by the Army Environmental Health Laboratory, Army Chemical Center, Maryland, but many of them have not been completely evaluated toxicologically.

Regulation two-piece army fatigue uniforms and coveralls of herringbone twill were impregnated with 2 grams per square foot of the individual repellents, 2.5 to 3.6 grams of the mixtures, and 1.6 and 1.7 grams of the active ingredient in the pressurized spray. The individual repellents and most mixtures were applied in acetone solutions, but one mixture (M-2089E) was applied in an emulsion. About 1,500 ml. of solution or emulsion was used to saturate a single coverall or a uniform consisting of fatigue jacket, trousers, and socks. About 70 grams of pressurized spray was used to treat a uniform. Three uniforms or coveralls were treated with each material, if a sufficient quantity was available. In aging, the uniforms were tested weekly for 4 to 6 weeks, or until they became ineffective, and in the wear tests after consecutive 8-hour periods of wear.

Subjects wearing the treated uniforms were exposed in tick-infested areas for 1 to 2 hours, depending on the abundance of the ticks. They alternately walked about, sat, and lay on the ground, in attempts to give all the uniforms equal exposure. Each day one subject wore an untreated uniform as a check. After exposure the subjects continued to wear the uniforms for about 45 minutes to give the ticks time to attach or drop off, according to the effectiveness of the repellent. The uniforms were then removed and all ticks on the clothing and body were counted. The effectiveness of the repellent was determined on the basis of the total number of attached and unattached ticks on the subjects wearing treated and untreated uniforms.

The results obtained in the aging tests are given in table 1.

In 1955 no individual repellent was as effective as the standard mixture, M-1960, which gave an average repellency of 97% for 6 weeks. Hexyl dipropionate averaged 97% repellency for 4 weeks and 87% for the next

[1] C. H. Schmidt, R. L. Fye, Nelson Smith, R. A. Sutton, H. R. Ford, and D. Adams took part in the testing and Capt. T. E. Sicay, of the 714th Medical Company (Preventive), U. S. Army, Fort Stewart, Georgia, assisted in the special wear test.

TABLE 1.—Aging Tests with Repellent-Treated Uniforms Against the Lone Star Tick. Three Uniforms Except as Noted.

ENT-No.	Repellent *	Percent repellency during indicated weeks after treatment 1	2	3	4	5	6
	1955 Tests						
Individual repellents							
6319	1,6-Hexyl dipropionate	99	100	94	95	89	85
5550	*N*-Benzoylpiperidine	94	95	92	97	71	78
20128	Heptyl mandelate	99	87	93	88	89	84
22542	Diethyltoluamide	88	93	95	86	73	—
17586	*O*-Chloro-*N*,*N*-diethylbenzamide	88	83	93	72	61	—
6269	Isopropyl *N*,*N*-dipropylsuccinamate	95	98	82	87	—	—
8296	2-(*o*-Allylphenoxy)ethanol	90	89	93	63	—	—
6024	Diisobutyl glutarate	93	82	80	—	—	—
12142	5-Ethyl-2,4-heptanediol **	88	70	—	—	—	—
15995	*n*-Butyl *o*-methoxybenzoate	88	59	—	—	—	—
5868	*o*-Hexyloxybenzaldehyde **	63	—	—	—	—	—
5903	4-*p*-Methoxyphenyl-2-butanol **, †	91	—	—	—	—	—
6259	10-Hendecen-1-ol **, †	98	—	—	—	—	—
12166	4,5,6,7(or 7*a*)-tetrahydrospiro[cyclohexane-1,3′-indan]-1′-one **, †	100	—	—	—	—	—
Diethyltoluamide pressurized sprays							
OM-859	Coarse	89	93	91	77	94	82
OM-860	Fine	98	96	90	88	87	—
OM-855	Aerosol	93	89	95	83	79	—
Mixtures *, ‡							
M-1960	3775 (30%), 2484 (30%), 523 (30%)	100	96	98	99	92	96
M-2097	2484 (30%), 523 (30%), 22542 (30%)	100	98	98	85	96	89
M-2099	523 (30%), 5974 (30%), 22542 (30%)	99	94	96	89	90	96
M-2107	5974 (35%), 22542 (55%)	99	94	96	89	90	96
M-2105	16807 (3%), 22542 (87%)	75	87	90	97	86	86
M-2106	20128 (35%), 22542 (55%)	96	87	97	84	87	—
M-2089E	15463 (18%), 22542 (72%)	98	91	91	81	84	—
M-2091	523 (18%), 22542 (72%)	90	91	91	87	87	—
M-2104	5974 (30%), 15463 (30%), 22542 (30%)	95	88	91	90	78	—
	1956 Tests						
M–1960*	3775 (30%), 2484 (30%), 523 (30%)	100	97	99	98††	—	—
20595**	*N*,*N*-Diethyl-*p*-isopropylbenzamide	95	93	90	83††	—	—
6312	*N*-Ethyl-*N*-(2-butyroxyethyl)-butyramide	95	92	89	69††	—	—
M–2112*	523 (30%), 22542 (60%)	89	96	90	89††	—	—

TABLE 1.—Aging Tests with Repellent-Treated Uniforms Against the Lone Star Tick. Three Uniforms Except as Noted.—(Continued)

ENT-No.	Repellent *	Percent repellency during indicated weeks after treatment					
		1	2	3	4	5	6
22542	Diethyltoluamide	93	81	90††	—	—	—
6435	1,2-Cyclohexyl diisobutyrate	91	86	62††	52††	—	—
5856	*p-sec*-Butoxybenzaldehyde	99	73	89‡‡	—	—	—
6251	Propyl *N,N*-dipropylsuccinamate	91	89	82††	—	—	—
5854	1,2,3,4-Tetrahydro-2-naphthyl butyrate	89	88††	82††	—	—	—
M-2091*	523 (18%), 22542 (72%)	91	78	—	—	—	—
6375	Methyl *N,N*-diisopropyl-glutaramate **	70	75‡‡	—	—	—	—
6383	1,5-Pentyl dipivalate **	67	87‡‡	—	—	—	—
3882	2(x,x-Diethylphenyl)ethanol †, ‡	96	—	—	—	—	—
5947	4-Methyl-3,5-nonanediol †	94	—	—	—	—	—
6245	Propyl *N,N*-dibutylsuccinamate †	94	—	—	—	—	—
6390	*sec*-Butyl *N,N*-diisopropylsuccinamate †	94	—	—	—	—	—
6393	*sec*-Butyl *N,N,*-dipropylsuccinamate †	97	—	—	—	—	—
6408	Ethyl *N,N*-diisobutylsuccinamate †	97	—	—	—	—	—
11009	Cyclohexyl phenyl ketone †, ‡	81	—	—	—	—	—
	1959 Tests						
M-1960*	3775 (30%), 2484 (30%), 523 (30%)	100	99	99	95	97	—
30146	*N,N*-Dibutyl-*p*-toluamide	98	99	96	97	93†	—
30126	*N,N*-Dibutyl-*m*-toluamide	99	99	98	98	95†	—
6365	Ethyl *N,N*-dipropylglutaramate	99	99	97	91	62	—
7447	*N*-Allyl-3-methyl-4-cyclohexene-1,2-dicarboximide	97	95	88	89††	94‡‡	—
6373	Methyl *N,N*-dipropylglutaramate	93	93	79	83††	61‡‡	—
18014	Reduced alcohol of butadiene furfural copolymer	95	98	77	79††	68‡‡	—
8184	*N*-Octyl bicycloheptene dicarboximide	97	94	92††	90††	96‡‡	—
5511	*trans*-2-(2,5-Xylyl)cyclohexanol	97	93	79††	97‡‡	—	—
22542	Diethyltoluamide	98	96	73	98‡‡	—	—
25211	2-Butoxyethyl octyl sulfoxide	99	80	52††	—	—	—
21987	2-(2-Butoxyethoxy)ethyl *o*-toluate	92	88	87††	80‡‡	—	—
4133	*N*-Octylsuccinimide	90	98††	87‡‡	89‡‡	—	—
30002	*N,N*-Dibutyl-*o*-toluamide †	100	—	—	—	—	—
25028	Octyl propyl sulfoxide †	99	—	—	—	—	—
9047	*o*-Cyclohexylphenol †	98	—	—	—	—	—

TABLE 1.—Aging Tests with Repellent-Treated Uniforms Against the Lone Star Tick. Three Uniforms Except as Noted.—(Continued)

ENT-No.	Repellent *	Percent repellency during indicated weeks after treatment					
		1	2	3	4	5	6
25209	Allyl octyl sulfoxide †	91	—	—	—	—	—
6560	Diethyl 2,6-dimethyl-4-oxo-2-cyclohexene-1,5-dicarboxylate	89	96††	92††	84††	97‡‡	—
1395	*N*-propylphthalimide	87	59††	—	—	—	—
25027	3-Chloropropyl octyl sulfoxide †	86	95††	—	—	—	—
30133	2-(2-Butoxyethoxy)ethyl *m*-toluic acid	83	39‡‡	—	—	—	—
30366	2-(*alpha*-Pentylstyryl)-*m*-dioxane	82	—	—	—	—	—
21050	*cis*-*N*-Heptyl-4-cyclohexene-1,2-dicarboximide	76	95	88‡‡	88‡‡	—	—
30276	2-(2-Butoxyethoxy)ethyl 2-(2-ethoxyethoxy)ethyl acetal of acetaldehyde	66	23‡‡	—	—	—	—
21559	*o*-Methylbenzyl chrysanthemumate ‡	45	—	—	—	—	—
12079	*N*-*n*-Butylformanilide †	—	—	—	—	—	—

* All mixtures contained 10% of an emulsifier, in addition to two or more of the following ingredients, which are indicated in the table by ENT number:
523—benzyl benzoate
2484—*N*-butylacetanilide
3775—2-butyl-2-ethyl-1,3-propanediol
5974—1-butyryl-1,2,3,4-tetrahydroquinoline
15463—*o*-phenyl phenol acetate
16807—lindane
20128—heptyl mandelate
22542—diethyltoluamide

** Only 2 uniforms treated.

† Uniform caused burning or irritating sensation on the skin.

†† Only 2 uniforms tested, one having failed in previous test.

‡ 1 uniform treated.

‡‡ Only 1 uniform tested, the others having failed in previous tests.

2 weeks, and benzoylpiperidine averaged 94% for 4 weeks and 75% for the next 2 weeks. Heptyl mandelate gave at least 84% repellency for 6 weeks and diethyltoluamide at least 86% for 4 weeks. Diethyltoluamide was about as effective in pressurized sprays as in the impregnation treatment. All the mixtures except the standard contained diethyltoluamide. M-2097, M-2099, and M-2107 were only slightly less effective than M-1960. M-2097 and M-2099 were similar to M-1960, but both contained diethyltoluamide in place of butyl ethyl propanediol, and M-2099 also contained butyryl tetrahydroquinoline in place of butylacetanilide.

In 1956 mixture M-1960 was the only treatment that consistently provided more than 90% repellency for 4 weeks. Diethyl isopropylbenzamide, ethyl butyroxyethyl butyramide, and mixture M-2112 were effective for 3 weeks. Diethyltoluamide gave only 81% repellency during the second week.

In 1959 M-1960 was again the most satisfactory, and consistently gave at least 95% protection for 5 weeks. The para and meta isomers of dibutyltoluamide also were effective for 5 weeks, but when high humidity was accompanied by profuse sweating they caused severe irritation to the skin. Ethyl dipropylglutaramate was effective for 4 weeks, and six repellents, including diethyltoluamide, were effective for 2 weeks.

The results of wear tests with diethyltoluamide, a mixture of diethyltoluamide and benzyl benzoate (M-2091), and the standard mixture (M-1960) are shown in table 2. The tests in series 1 and 2 were conducted at Richmond Hill, using uniforms impregnated with acetone solutions, and those in series 3 at Camp Stewart, using uniforms impregnated with emulsions. In series 1 and 3 the periods of wear were begun on the day after treatment, and in series 2 they were begun after 7 days. The uniforms treated with M-1960 were highly effective after 32 to 48 hours of wear, whereas M-2091 and diethyltoluamide gave good protection through only 8 to 16 hours of wear.

TABLE 2.—Wear Tests with Repellent-Treated Uniforms Against the Lone Star Tick, 1956.

Repellent *	Percent Repellency after Indicated Hours of Wear					
	8	16	24	32	40	48
	Series 1 (2 Uniforms)					
M-1960	99	91	92	96	92	93
M-2091	98	78	64	90	85	77
Diethyltoluamide	52	55	40	75	51	51**
	Series 2 (2 Uniforms)					
M-1960	99	99	97	97	87	—
M-2091	95	91	77	—	—	—
Diethyltoluamide	93	95	75	85**	82**	—
	Series 3 (4 Uniforms)					
M-1960	—	98	100	98	85	95†
M-2091	—	88	88	82†	68†	89†
Diethyltoluamide	—	89	82†	79	18†	65†

* Mixture formulas given in table 1.
** Only 1 uniform tested, 1 having failed in previous test.
† Only 2 uniforms tested, others having failed in previous test.

Summary

Field tests were conducted in 1955, 1956, and 1959 with 54 individual repellents, 13 mixtures, and 3 pressurized sprays in areas heavily infested with nymphs and adults of the lone star tick, *Amblyomma americanum* (L.). None of the new repellents was as effective as the standard, M-1960. Three mixtures containing various concentrations of diethyltoluamide with butyryl tetrahydroquinoline and/or butylacetanilide and benzyl benzoate were only slightly less effective than the standard. The most effective individual re-

pellents were 1,6-hexyl dipropionate, *N*-benzoylpiperidine, heptyl mandelate, *N,N*-diethyl-*p*-isopropylbenzamide, *N*-ethyl-*N*-(2-butyroxyethyl) butyramide, and ethyl *N,N*-dipropylglutaramate. The meta and para isomers of *N,N*-dibutyltoluamide were also highly effective but were irritating under extreme sweating conditions. Diethyltoluamide and six other compounds were next in effectiveness.

Literature Cited

Cole, M. M., and *C. N. Smith.* 1950. Tick repellent investigations at Bull's Island, S. C. 1948. Jour. Econ. Ent. 42(6): 880-883.

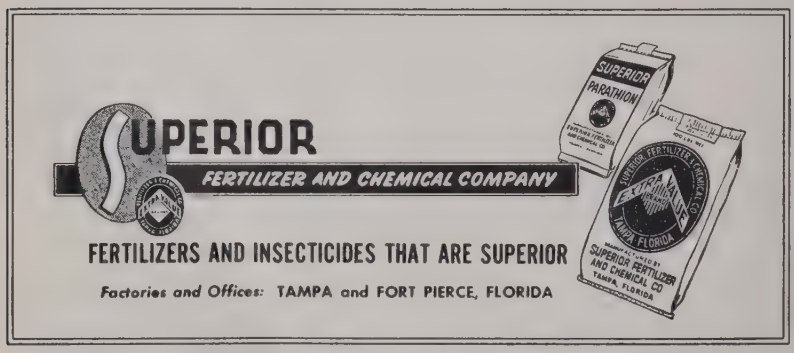
Gouck, H. K., and *I. H. Gilbert.* 1955. Field tests with new tick repellents in 1954. Jour. Econ. Ent. 48(5): 499-500.

Smith, C. N., and *D. Burnett, Jr.*, 1948. Laboratory evaluation of repellents and toxicants as clothing treatments for personal protection from fleas and ticks. Amer. Jour. Trop. Med. 28(4): 599-607.

Smith, C. N., M. M. Cole, I. H. Gilbert, and *H. K. Gouck.* 1954. Field tests with tick repellents—1949, 1950, and 1952. Jour. Econ. Ent. 47(1): 13-19.

Smith, C. N., M. M. Cole, E. A. Jones, and *J. C. Clark.* 1949. Investigations of tick repellents at Camp Bullis, Texas, 1948. Jour. Econ. Ent. 42(5): 716-720.

Smith, C. N., and *H. K. Gouck.* 1946. Observations on tick repellents. Jour. Econ. Ent. 39(3): 374-378.



A NEW SPECIES OF *CHELOPISTES* (MALLOPHAGA) FROM TEXAS AND MEXICO

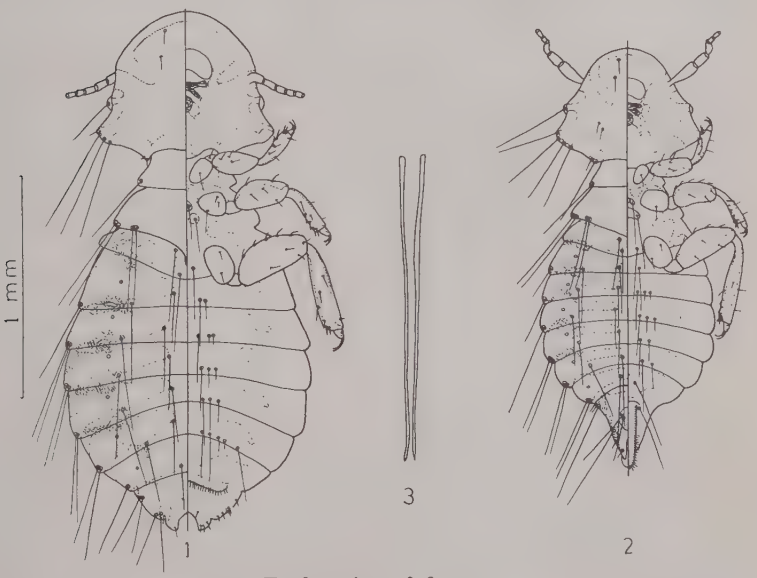
K. C. Emerson
Stillwater, Oklahoma

A new species of *Chelopistes*, collected in Texas and Mexico off the Chachalaca, is herewith described and illustrated. *Chelopistes meleagridis* (Linnaeus, 1758), a common parasite on the turkey, is the only other species of this genus known from North America (north of Mexico). Species of the genus are rather common on neotropical gallinaceous hosts found south of the United States.

Chelopistes texanus n. sp.

Male. General shape and chaetotaxy as shown in figure 2. Minute setae of head, omitted in figure 2, normal. Male genitalia as shown in figure 3.

Female. General shape and chaetotaxy as shown in figure 1. Minute setae of head, omitted in figure 1, normal. Internal bands of pleurites as



Explanation of figures.

All figures pertain to *Chelopistes texanus* n. sp. Figures 1 and 2 are drawn to the same scale.

Fig. 1. Dorsal-ventral view of female.
Fig. 2. Dorsal-ventral view of male.
Fig. 3. Male genitalia.

in *C. latifrons* (Carriker, 1945).[1] Small setae on posterior margin of vulva more abundant than in *C. latifrons*.

Discussion. This species is closest to *C. latifrons* (Carriker, 1945) found on *Ortalis guttata adspersa* (Tschudi). The two posterior, thoracic, sternal plates of *C. latifrons* each possess 2 long setae; in *C. texanus* these plates each have 1 long setae. In the male, *C. texanus* possesses 2 long setae on the median posterior margin of the head, while *C. latifrons* possesses 4 long setae. Central chaetotaxy of abdominal sternites II-VII is more abundant in *C. texanus*. In addition, *C. texanus* is much larger in all measurements for both sexes. The male genitalia do not appear to be distinctive.

Type Host: *Ortalis vetula mccalli* (Baird), Chachalaca.

Type Material: Holotype male collected at Rio Atoyae, Vera Cruz, Mexico, April 12, 1947, by E. P. Edwards; 1 male paratype with the same data. Allotype female collected on November 7, 1954, in Southeast Texas (exact location and collector unknown); 1 female paratype with the same data. Three female paratypes collected at Zamorina, Tamaulipas, Mexico on May 10, 1949, by W. B. Heed. One male and 1 female paratype collected at Wibank Rio, Tamaulipas, Mexico on February 18, 1949, by W. B. Heed. Paratypes in the British Museum (Natural History) are: 3 collected in October, 1921, in South Texas; 2 collected in Yucatan, Mexico; and 4 collected in September, 1889, in Guatemala. The specimens from Yucatan, Mexico, are off *Ortalis vetula vetula* (Wagler); and the specimens from Guatemala are off *Ortalis vetula leucogastra* (Gould). The holotype and allotype will be deposited in the U. S. National Museum.

Carriker's figures of *C. latifrons* are in error in certain details. In his figures, abdominal tergites II-VII are shown as sternites. The faintly colored abdominal sternal plates are omitted. The chaetotaxy of abdominal segments II-VII is all shown as ventral.

[1] *Carriker, M. A.* 1945. Studies in Neotropical Mallophaga (VII), *Goniodes* and allied genera from gallinaceous hosts. Rev. Acad. Colomb. Sci. 6: 355-399.

NOTICE TO MEMBERS

The 44th Annual Meeting of the Florida Entomological Society will be held in association with the Entomological Society of America. These meetings are scheduled for November 27-30, 1961, at Miami, Florida, and will be held at the McAllister and Columbus Hotels.

NOTES ON A PARASITE OF THE CITRUS ROOT WEEVIL, *PACHNAEUS LITUS* (GERM.)

R. M. Baranowski
Sub-Tropical Experiment Station
Homestead, Florida

The citrus root weevil, *Pachnaeus litus* (Germ.), is not considered a major pest of citrus in Florida but occasionally causes serious damage, particularly along the lower east coast. The adult weevils feed on the foliage, the injury typically appearing as notches along the leaf margin. The larvae cause much more serious injury by feeding on the root cortex, usually on the underside of the roots but where high populations are present complete girdling often occurs.

During the course of investigations on the citrus root weevil in 1957, several egg masses were collected and brought to the laboratory to obtain a supply of newly hatched larvae to infest potted trees. A trichogrammatid wasp emerged from a high percentage of the eggs. Specimens were sent to Dr. P. W. Oman of the Insect Identification and Parasite Introduction Research Branch, U. S. D. A., and subsequently they were identified by Dr. B. D. Burks as *Ufens osborni* Dozier. According to Dr. Oman's report (*in litt*, May 21, 1959) this species has not been known previously from the United States.

Dozier (1932)[1] described *U. osborni* from a series of specimens reared by H. T. Osborn at Central Aguirre, Puerto Rico, from eggs of the sugar cane root weevil, *Diaprepes abbreviatus* L.

From a series of egg masses obtained during May and June, 1957, less than 2% of the weevil larvae hatched out of the 623 eggs. Adult *U. osborni* emerged from 81% of the eggs. During the month of September, 11 additional egg masses were collected. Of these, 2 masses were not parasitized, 8 produced parasites only, and 1 yielded an equal number of citrus root weevil larvae and parasites.

The appearance of citrus root weevil populations has always been sporodic, adults appearing in a grove one year and disappearing the next. Occasional adults have been collected since 1957, but no egg masses have been seen. This is not to infer that they are not present, but that the citrus root weevil population has remained at a very low level.

It is tempting to speculate that the conditions during 1957 were such that parasitization by *U. osborni* reduced the citrus root weevil population to such an extent that it has not been able to build up again to significant numbers. It is hoped that the effectiveness of this parasite as a biological control agent can be fully evaluated in the future.

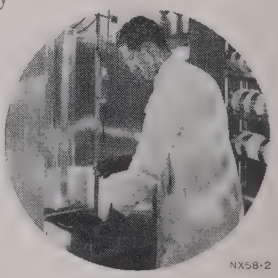
[1] Dozier, H. L. 1932. Descriptions of new trichogrammatid (Hymenoptera) egg parasites from the West Indies. Proc. Ent. Soc. Washington 34 (3): 29-37.

HERCULES RESEARCH–

First Step toward Improved Pesticides

From the Hercules Research Center and Agricultural Chemicals Laboratories come an ever increasing number of products that contribute to more productive farming and increased comfort for leisure hours. Here are the established members of the Hercules family: *Toxaphene agricultural insecticide; Thanite® for oil base and aerosol insecticides; Delnav* phosphate pesticide; meta Delphene® insect repellent.*

Today in the laboratories, research continues on the products that will join them in the future. But before they become available you can be sure that thousands of compounds have been carefully screened and extensive tests conducted in the field because only the best is good enough to meet the standards of Hercules research. That's why you can look to Hercules for leadership in the development of insecticides, fungicides, and herbicides.



Agricultural Chemicals Division, Naval Stores Department

HERCULES POWDER COMPANY

INCORPORATED

900 Market Street, Wilmington 99, Delaware

**Trademark*

NX58-2

MINUTES OF THE FORTY-THIRD ANNUAL MEETING

A pre-meeting "bull session" was held in the Oxford-Dover Room of the Robert Meyer Hotel, Jacksonville, on Wednesday evening, September 7, 1960, from 7:30 to 9:30 P.M.

The meeting convened in the Windsor Room of the Robert Meyer Hotel, Jacksonville, at 9:00 A.M. on Thursday, September 8, 1960, with President Andrew J. Rogers presiding. The two day program consisted of 28 submitted papers, 4 invitational papers, 2 symposia, and one panel discussion. The Annual Banquet was preceded by the hospitality hour, sponsored by members of industry, on the evening of September 8th.

The first business session convened at noon on September 8th with President Rogers presiding. Since the minutes of the Forty-second Annual Meeting had been published in the *Florida Entomologist* (42[4]: 179-182), they were approved as printed.

The President appointed the members of the Auditing and Resolutions committees. President Rogers informed the members of the decision of the Executive Committee to hold the Society's 1961 Annual Meeting in Miami jointly with the 1961 Annual Meeting of the Entomological Society of America. A committee is to be formulated from those who plan to attend the 1960 E.S.A. meeting in Atlantic City, N. J. This committee would then guide arrangements for the 1961 joint meeting of our Society and E.S.A.

The Report of the Treasurer-Business Manager was presented by Dr. R. E. Waites who has served in this important capacity since 1958.

REPORT OF TREASURER-BUSINESS MANAGER FOR YEAR ENDING AUGUST 31, 1960

Receipts:

Registration Fees	$ 393.00
Banquet Fees	343.50
Membership Dues (1959-60)	1299.00
Subscriptions	410.25
Advertisements	1317.31
Reprints	226.76
Back Numbers	242.00
Plates and Etchings	177.59
Sale of Slides—Entomology in Action	28.40
	4437.81
Cash on Hand 8/31/59	1587.33
	$6025.14

Disbursements:

Keystone Press of Miami	$ 50.00
Cole's Flowers—Centerpiece for Banquet	10.30
Boulevard Piano Co.—Rental of Organ for Banquet	25.00
Bud Snyder—Banquet Expenses (Musicians, Food, etc.)	56.36
Alfred S. Mills—Reimbursement for Plastic Badges	10.82
McAllister Hotel—Banquet Charges	438.96
L. A. Hetrick—Secretary—Postage	51.00
Lewis Berner—Editorial Expenses	10.00
Business Envelope Manufacturing Co.—5M Return Address Envelopes	22.85
Railway Express Agency—Shipping Charges on Envelopes	3.15
Chesnut Office Equipment Co.—Record Book for Business Manager	3.77
Pepper Printing Co.—Printing of "The Florida Entomologist"	2229.97
Postmaster, Gainesville, Florida—Postage and Box Rent	30.90
Eastman Kodak Stores, Inc.—3 sets slides "Entomology in Action"	35.49
Chesnut Office Equipment Co.—File Drawer for Secretary	8.86
Bank Service Charge	.10
	2987.53

Cash on Hand 8/31/60	3037.61
	$6025.14

Respectfully submitted,
R. E. Waites, Business Manager

The report of the Treasurer-Business Manager was adopted by voice vote. (Although the work of the Auditing Committee had not yet been done and their report was not presented until the following day, it is recorded at this point in the minutes for continuity).

Report of Auditing Committee

The Auditing Committee has carefully examined the records and reports for the Florida Entomological Society for the period ending August 31, 1960, and finds them correct.

The committee wishes to commend Dr. R. E. Waites, for the neat and orderly manner in which we received the records.

The Auditing Committee
G. H. Beames
H. D. Woofter
G. W. Dekle, Chairman

The Report of the Special Committee to make Recommendations on Improving the Standards and Status of Professional Entomology was presented by Dr. John W. Wilson. The report, with modifications from the final business session, was as follows:

Report of the Special Committee to Make Recommendations on Improving the Standards and Status of Professional Entomology

Recommendations of this committee follow:

(1) That Article II, Section 6 of the bylaws be amended at the next annual meeting to increase the membership of the Public Relations Committee from 3 to 11 members and that the scope of the Public Relations Committee be broadened.

(2) That the incoming president appoint an interim committee to be known as the Advisory Council which shall have the following duties:

A. To supply information to the Public Relations Committee on matters of interest to the entomological profession and the public.

B. To appear at public hearings on matters which affect the interests of the entomological profession.

C. To keep informed on all public affairs affecting entomology, including legislation, and to represent the Society in all such matters by offering advice and council to the State Government and to the public in these matters.

D. To make an annual report at each annual meeting to the Society on activities conducted.

E. Improve the status of professional entomology.

(3) That the membership of the Interim Advisory Council will consist of 11 members with one member representing the following phases of the profession: 1. Industrial Entomology; 2. Structural Pest Control Industry; 3. The U.S.D.A. Agricultural Research Service (Entomology Division); 4. The Agricultural Experiment Stations; 5. Educational Entomology; 6. Regulatory Entomology (Federal); 7. Florida State Plant Board; 8. Control (State or Federal); 9. Public Health Entomology (State or Federal); 10. Extension Entomology; 11. Forest Entomology.

(4) That the chairman of the present Public Relations Committee be a member of the Interim Advisory Council.

(5) That the membership of the enlarged Public Relations Committee

represent the phases of entomology specified for the Interim Advisory Council and that the duties of the enlarged Public Relations Committee include the duties of the Interim Advisory Council.

(6) That, in order to give the membership time to consider the above report and to make suggested modifications of the recommendations, action on the report be deferred to the final business session of this annual meeting.

John T. Creighton
J. T. Griffiths
M. L. Wright
John W. Wilson, Chairman

Dr. D. O. Wolfenbarger presented the report of the Honors and Awards Committee.

The purpose and function of this committee is to honor and to present appropriate awards to entomologists who make outstanding contributions to science and to the public. Members of this committee recognized that there were many problems in connection with selecting and honoring individuals and organizations. These members recognized the need to promote interest, incentive, and drives to extend entomological progress. They recognized also the value, however, of bringing to the attention of the public something of entomological progress.

The Committee recommends:

1. A committee be appointed each year to examine and evaluate entomological progress, to search for worthwhile candidates for honors.
2. The committee consider all instances but it need not necessarily honor any individual nor organization.

Dr. J. T. Griffiths
Dr. E. G. Kelsheimer
Dr. Milledge Murphy, Jr.
Dr. A. A. Whipp
Dr. D. O. Wolfenbarger, Chairman

(This committee selected Dr. Loren F. Steiner as the recipient of the 1960 Award for his outstanding work on the biology of fruit flies and the development of attractants for these insects. Dr. Steiner is associated with the U.S.D.A. Fruit Fly Laboratory, Honolulu, Hawaii. The award of a suitable plaque was made to Dr. Steiner "in absentia" by Dr. Wolfenbarger and received by Dr. B. A. Porter of U.S.D.A.).

The second business session convened at 4:00 P.M. on September 8th with President Rogers presiding. The Report of the Committee on History of the Society was given by Dr. Tissot.

Report of Committee on History of the Society

An article entitled "History of the Florida Entomological Society" was prepared and a copy of the manuscript sent to Dr. E. C. Nance, President Emeritus, University of Tampa, who accepted it for use in his forthcoming History of Florida. A copy also was submitted to the *Florida Entomologist* and Editor Lewis Berner reports that the article may appear in the December, 1960 number.

L. A. Hetrick
Andrew J. Rogers
A. N. Tissot, Chairman

Dr. Milledge Murphey reported for the Committee on Necrology. The Society regrets the death of member J. William Decker, Fernandina Beach. (The Secretary wrote to surviving members of Mr. Decker's family shortly after his death. Also a short obituary note was carried in the *Florida Entomologist* (43[2]: 93). Mrs. Decker was most appreciative of these courtesies.)

Mr. M. Lewis Wright, Chairman of the Entomology in Action Committee, did not attend the meeting and no report was submitted by this committee. The Secretary reported that during the year the Executive Committee had authorized the printing of additional copies of the Entomology in Action Kodachrome slide series. Three additional sets of these pictures were made. One set was sold to Entomological Society of America for use by the Executive Secretary in support of talks given before various groups. One set was sold to Kilgore Seed Co., Plant City, Florida. The third set is currently held by the Secretary and the original series has been returned to Mr. Wright. There is no record of how many people have viewed these pictures during the past year.

Mr. James E. Brogdon reported on the activities of the Membership Committee.

Dr. Lewis Berner presented the report of the Committee on Sustaining Memberships.

Report of the Committee on Sustaining Memberships

It is the opinion of this committee that the Florida Entomological Society should not institute sustaining memberships. The members of this committee feel that the Society is already being adequately subsidized by commercial organizations through advertising and through their contributions to our hospitality hour and that any further request to these organizations would produce an unfavorable reaction toward the Society.

This committee consulted the minutes of the Entomological Society of America to determine how that Society handled its sustaining associates. Their associates contribute $100.00 per year or more to the Society.

The committee then estimated that it costs the Florida Entomological Society approximately $10.00 per page to print an advertisement in the *Florida Entomologist* for which the advertiser is currently charged $35.00. This means that an organization that carries an advertisement in the *Florida Entomologist* is, to all intents and purposes, subsidizing the Society to the extent of $25.00 per issue or $100.00 per year. Those organizations carrying a half page ad are supplying the Society with $60.00 per year above the cost of printing.

Each year, at least for the last ten, commercial entomologists have been donating a sum of money to the Society to be used at its annual meeting for the hospitality hour. This has been a very successful and enjoyable affair. Not only has it enabled its members to get together socially at the meetings, but the Society has also gained financially through the residue left after all costs are paid. When the sums supplied for the hospitality hour and advertising are considered it becomes very clear that the Florida Entomological Society is already being subsidized to the extent of more than $100.00 by those organizations which carry full page advertisements in the *Florida Entomologist* and to a lesser degree by those who do not carry advertising. This committee therefore recommends that the Florida Entomological Society withdraw the proposal for instituting sustaining memberships.

L. A. Hetrick
R. E. Waites
Lewis Berner, Chairman

Dr. Lewis Berner presented the report of the Committee on Exchanges of the *Florida Entomologist*.

Committee on Exchanges of the Florida Entomologist

This committee considered at some length the matter of exchanges of the *Florida Entomologist* with other journals published by other biological or entomological societies. The recommendation of this committee is that the policy of exchanges be continued. Presently, from the best information that was available to the committee, there are four subscriptions being given as gifts, all of which were approved by the executive committee or by the

Society as a whole, and eighteen exchanges. Many years ago the Florida Entomological Society approved the deposit of these exchanges in the University of Florida Libraries where they are available to any entomologist in the state. This committee feels that this has been a most worthwhile activity on the part of the Society especially in view of the fact that the organizations with which exchanges are made are almost entirely foreign. These foreign organizations are small biological or entomological societies which would not have adequate funds to subscribe to the *Florida Entomologist*. The Florida Entomological Society, also being a small organization, benefits by receiving their publications and many of the journals received are much more voluminous than the *Florida Entomologist* and most of them are producing important basic information in the field of entomology.

In addition to recommending that the policy of exchanges be continued, this committee also recommends that the Society authorize the expansion of exchanges on a limited scale. No exchange is to be instituted without the approval of both the business manager and the editor.

Presently, the Society prints an issue of 650 numbers. Approximately 450 of these are put in the mail to subscribers and members leaving a residue of about 200. This residue over the course of years has created a storage problem. The committee feels, therefore, that the mailing of a small number of exchange items benefits the Society additionally by reducing the backlog of unsold copies.

L. A. Hetrick
R. E. Waites
Lewis Berner, Chairman

President Rogers thanked the members of the Program Committee for their fine work. Mr. Herman S. Mayeux, Chairman of this Committee, proposed the continuation of the pre-meeting "bull session" and exhibits in future years and so moved. This motion was seconded by John Wilson. Discussion followed. Continuation of annual exhibits was adopted by voice vote. The "bull session" was further discussed and amended by Lewis Berner to permit more flexibility in the future. F. Gray Butcher moved, and Frank Mead seconded, a motion to "table" the "bull session" motion. The motion was "tabled" by voice vote.

The session adjourned in time to permit the members to prepare for the Hospitality Hour and Banquet.

The final business session was convened at 2:15 P.M. on Sept. 9th by President Rogers.

Chairman of the Local Arrangements Committee, John A. Mulrennan, reported on the work of his group to assure the success of the Meeting.

President Rogers commented on the fine work of the Public Relations Committee. The proposal of a change in the by-laws to permit a larger Public Relations committee was given further attention. Minor changes were moved and adopted. (These changes have been incorporated into the report of the Committee on Improving the Standards and Status of Professional Entomology as printed in these minutes.)

President Rogers commented on a proposal that Florida Entomological Society become an affiliate of Entomological Society of America. A motion was made and seconded that the incoming President appoint a committee to investigate the advantages and responsibilities of affiliation with E.S.A. If favorably impressed, this committee is then to have the power to act for the Society prior to the annual E.S.A. meeting in November-December 1960. The motion was passed by voice vote.

Herman Mayeux requested that the winners of the exhibits awards be recorded in the minutes. The Executive Committee had authorized an award of 2 years Society dues for the best member exhibit and 1 year student member dues for the best junior exhibit. The award of 2 years dues was won by John Porter and his daughter for their exhibit on preservation of spider webs. The junior exhibit award was made to William J. Platt, III for his exhibit of butterflies.

Mr. Henry S. Chubb, Chairman of the Resolutions Committee, thanked

the Committees on Program and Local Arrangements, industrial contributors to the hospitality hour, the hotel, invitational and out-of-State speakers, and exhibitors.

President Rogers thanked the various Society officers and committee members for their cooperation during the past year.

President Rogers requested the report of the Nominating Committee.

Report of Nominating Committee

President ..... Lewis Berner
Vice-President ..... W. C. Rhoades
Treasurer-Business Manager ..... R. E. Waites (continuing)
Secretary ..... L. A. Hetrick
Executive Committee ..... John R. King
(replacement for G. G. Rohwer for 1 year)
Executive Committee ..... R. W. Baranowski (2 year term)
Editor ..... Lewis Berner
Associate Editor ..... Norman Hayslip

Respectfully submitted,
F. Gray Butcher
Joseph Nicholson
W. B. Tappan
Paul J. Hunt, Chairman

There were no additional nominations from the floor. It was moved, seconded, and voted that the Secretary be instructed to cast a ballot to elect the slate of officers presented by the Nominating Coommittee.

The newly elected President, Dr. Lewis Berner, was escorted to the platform and retiring President Rogers conveyed the Society's gavel to him. Dr. Berner thanked the members of the Society for the confidence and trust placed in him. President Berner adjourned the meeting at 3:05 P.M.

Membership

Currently, the Society has 303 members. The following new members joined the Society since the last annual meeting.

Bargren, Wm. C. 1840 N. W. 44th Ave., Rt. 3, Gainesville.
Beck, Elizabeth C. (Mrs.) 1621 River Bluff Rd., Jacksonville.
Blackwell, Wm. L. P. O. Box 868, Ft. Pierce.
Boike, Arthur H. 402 N. W. 35th St., Gainesville.
Burditt, Arthur K., Jr. 2120 Camden Road, Orlando.
Clements, B. W., Jr. 1663 31st Ave., Vero Beach.
Cowperthwaite, Wm. G., State Plant Board, Seagle Bldg., Gainesville.
Davis, A. Nelson, Jr. 3610 Chelsea Ave., Orlando.
Golsen, Eugene W., 3640 N. W. 64th Ave., Miami Springs.
Grant, V. F., 307 Interbay Ave., Warrington.
Platt, Wm. J., III. Rt. 3, Box 627 A, Gainesville.
Rathburn, Carlisle B., Jr. P. O. Box 308, Vero Beach.
Schmidt, Claude H., 1525 Vantage Drive, Orlando.
Shields, S. E., 2241 Saul Drive, Jacksonville 11.
Sparkman, Perry L., P. O. Box 952, West Palm Beach.
McKay, Don, 142 174th Terrace Drive, Reddington Shores, St. Petersburg 8.
Weidhaas, Donald E., 2217 Buckminster Circle, Orlando.
Wilkinson, Robert C., Jr., Newell Hall, Univ. of Florida, Gainesville.

Sessions of the Executive Committee were held on the evening of September 7th and during the noon hour on September 9th.

L. A. Hetrick
Secretary

NEPYTIA SEMICLUSARIA (Wlk.) AS A DEFOLIATOR OF PINE (LEPIDOPTERA: GEOMETRIDAE)

L. A. Hetrick
College of Agriculture, University of Florida

On a trip through Lake County, Florida, in April, 1960, defoliation of sand pine, *Pinus clausa* Vasey, was readily apparent to me from the highway. Although the presence of sawfly larvae was suspected, this defoliation was being caused by relatively large geometrid larvae.

These larvae were approximately 2 inches in length, pale yellow, and marked with a wide orange-red dorsal stripe and thin longitudinal lines of black and white. Head capsules, thoracic legs, and prolegs were orange marked with flecks of brown. Although the larvae were colorful, they were difficult to see among the pine foliage on which they were feeding.

Preserved larvae were sent to the U. S. National Museum for possible identification. Mr. H. W. Capps was unable to associate the larvae with adults though identical larvae from sand pine at Orlando had been submitted to the Museum in 1931 by W. W. Yothers.

Additional larvae were collected and held for rearing of adults. Larvae were in their last feeding instar at the time of collection. Feeding of the larvae was confined to the pine needles produced during the previous year and was not observed on the tender expanding needles of the new growing season.

Pupation occurred among the green needles of the previous year. Prior to pupation, a larva would loosely tie a number of needles together with strands of silk. This could hardly be called a "cocoon" yet it did serve to protect the beautiful tan and white pupal stage which lasted about 2 weeks. Under field conditions some pupae occurred among Spanish moss, *Tillandsia usneoides* L., growing on heavily infected trees.

When adults were recovered from the rearings, they could readily be identified as *Nepytia semiclusaria* (Wlk.), a species which had been collected at lights in Gainesville during previous seasons. The occurrence of adults at Gainesville argues against the species being restricted to sand pine as this tree does not grow in the vicinity of the city. Tietz (1952) lists food plants as *Abies* sp. (firs), *Larix laricina* DuRoi (larch), *Picea* sp. (spruce), *Pinus* sp. (pines), and *Tsuga canadensis* L. (hemlock) and records adult specimens collected from the Upper Austral, Transition, and Canadian life zones in Pennsylvania. Although Packard (1873) described the adult of this insect under a synonomous name, his specimens were from Albany, N. Y., and Maine. Holland (1915) states that "the moth occurs in the northern portions of the United States".

Caged adult moths from the rearings were observed for information on oviposition habits. These moths repeatedly refused fresh pine foliage for oviposition, however, when corky bark from loblolly pine, *Pinus taeda* L., was introduced into the cage, this was readily accepted. Eggs were laid in masses of a few to a hundred or more beneath the loose bark scales. The eggs were pale green, oblong, somewhat flattened, and with a sunken cap on one end. After a few days, the color of the eggs had changed from green to brown.

Although eggs have been held under observation, hatching did not occur.

Adult specimens have been collected in May and June at Gainesville. Collections in Pennsylvania have been made in September and October (Tietz, 1952). This indicates that the species likely has a single annual generation wherever it occurs in North America. Low winter temperatures, followed by higher spring temperatures, appear to be needed to stimulate egg development. It is estimated that hatching of the eggs, under conditions prevalent in central Florida, would occur about the middle of March.

Since this insect has a single annual generation, and the larvae consume only those needles of the previous year's production, it is not expected to become a serious defoliator of pine. New growth is underway at the time the larvae are feeding on the older needles. The trees recover rapidly and by mid-summer show little indication of the spring defoliation. Since the insect is native, it has its own complement of natural enemies though none of its parasites were recovered in the course of the rearing studies.

Summary

Defoliation of sand pine trees in a part of Lake County was caused by larvae of *Nepytia semiclusaria* (Wlk.). Identification of the species from the larvae could not be made but as adults were reared a name could be applied. Rearings have shown that pupation takes place among green foliage on the trees. Adults of this species have been collected at lights in Gainesville, which indicates that larval feeding is not restricted to sand pine. Eggs are laid beneath the bark scales on the trunks of pine trees. Apparently the insect has a single annual generation wherever it occurs in North America.

Literature Cited

Holland, W. J., 1915. The moth book. Doubleday, Page & Co., Garden City, N. Y., p. 343,

Packard, A. S., 1873. Fifth Report Peabody Academy of Science, p. 78.

Tietz, H. M., 1952. The Lepidoptera of Pennsylvania. Penn. Agric. Exp. Sta., p. 145.

INDEX TO VOLUME 43, 1960

Anchylopera platanana, biology of, 81
Anthony, D. W., article by, 77

Baranowski, R. M., article by, 197
Bell, R., article by, 103
Beer, R. E., article by, 23
Bees of the Eastern United States, review of, 187
Blattella germanica, silica dusts against, 99
Brevipalpus albus, n. sp., 179
alni, n. sp., 183
chucumayi, n. sp., 179
crotoni, n. sp., 177
ewpristori, n. sp., 180
filifer, n. sp., 182
formosus, n. sp., 177
hypti, n. sp., 175
insinuatus, n. sp., 180
lagasceae, n. sp., 176
levis, n. sp., 183
mori, n. sp., 184
oaxacensis, n. sp., 182
oreopanacis, n. sp., 180
perseae, n. sp., 182
pseudoleptoides, n. sp., 176
quercicolus, n. sp., 175
religiosae, n. sp., 186
rugosus, n. sp., 184
serratus, n. sp., 176
striatus, n. sp., 183
testudinalis, n. sp., 186
tuberellus, n. sp., 177
variolatus, n. sp., 184
Burden, G. S., article by, 15, 99

Cabbage looper, control of, 65
Calyptodesmus, 148
schubarti, n. sp., 148
Causey, N. B. article by, 147
Chelopistes texanus, n. sp., 195
Christenson, L. D., article by, 163
Christie, J. R., article by, 43
Citrus insects, seasonal populations of, 49
mites, seasonal populations of, 49
root weevil, parasite of, 197
sprays, 59
Clarke, J. F. G., article by, 115
Cohen, M., article by, 59
Corn earworm control, use of DDT, 69

Decker, J. W., obituary, 93
De Leon, D., article by, 175
Denmark, H. A., article by, 81
Du Chanois, F. R., article by, 37

Eastin, J. L., article by, 15, 99
Eggs, deposition of, 1
insect, 1
photography, 6
preservation, 5
Emerson, K. C., articles by, 195
Entomologists, interests of, 43
Entomology, profession of, 156
science of, 155
Eupalopsellid mites, 119
Eupalopsellidae, 124, 125
Eupalopsellus, 125
olandicus, 126
rostridius, n. sp., 128
trudis, n. sp., 130
Eupalopsis acus, n. sp., 122
pini, 121
Exothorhis, n. gen., 131
armata, n. sp., 135
caudata, n. sp., 131

Florida Entomological Society, Minutes of 43rd Annual Meeting, 199
Fruit fly research, 163

Genung, W. G., article by, 65
German cockroaches, 15
dusts against, 15
silica dusts against, 99
sprays against, 15
Gilbert, I. H., article by, 189
Gouck, H. K., article by, 189

Greasy spot disease, field tests against, 60
Griffiths, J. T., article by, 29
Ground beetles on cotton, 103
Gurney, A. B., article by, 9

Hermetia illucens, control of, 19
Hetrick, L. A., article by, 204
Holcocera lepidophaga, n. sp., 115
Hughes, I. W., article by, 89

Insect pathogens, 65
Insecticide-pathogen combinations, 65

Johnson, R. B., article by, 59

King, J. R., article by, 59

LaBrecque, G. C., article by, 19
Larvicides, 19
  for control of house flies, 19
Light traps, Tabanidae attracted to, 77
Lobesia liriodendrana, adults, 105
  eggs, 107
  larvae, 109
  larval instars, 110
  leaf skeletonizer, 105
  natural enemies, 113
  oviposition, 107

Mediterranean fruit fly, 163
Melon fly, 163
Mexican fruit fly, 163
Mexico, *Brevipalpus* in, 175
Millipeds, Neotropical, 147
Miticides, 29
Musca domestica, control of, 19

Nematologists, interests of, 43
Nepytia semiclusaria, 204

Oecanthus allardi, n. sp., 9

Pachnaeus litus, parasite of, 197
Peterson, A., article by, 1, 105
Philip, C. B., article by, 171
Pine defoliator, 204
Pine, moth injurious to, 115
Porter, B. A., article by, 163
Pseudaulacaspis pentagona, natural enemies of, 89

Red spider control, 33
Rogers, A. J., article by, 155
Roplisa, suppression of, 139
Rust mite control, 29
Rust mite, field tests against, 60

Saniosulus, n. gen., 135
  nudus, n. sp., 135
Simanton, W. A., article by, 49
Strigmaeidae, 124
Structural pest control act, 37
Stylodesmidae, key to family, 147
Summers, F. M., article by, 119

Tabanus imitans pechumani, n. subsp., 171
Tick repellents, field tests of, 189
Trichoplusia ni, control of, 65
Trigonopeltastes, key to species of, 141
  delta, 144
  floridana, n. comb., 139

Ufens osborni, 197

Walker, T. J., article by, 9
Whitcomb, W. H., article by, 103
White peach scale, natural enemies of, 89
Wilson, H. G., article by, 19
Wilson, J. W., article by, 69
Woodruff, R. E., article by, 139

Xenotarsonemus denmarki, n. sp., 23

COMMONWEALTH INST.
ENTOMOLOGY LIBRARY
11 APR 1961
SERIAL U.S.A.109
SEPARATE